The Journal of Experimental Education

A periodical report of scientific investigations relating to child development, curriculum, learning, teaching, supervision, measurements, statistics, and experimental techniques.

Vol. XXVI | December 1957 | No. 2

CONTENTS

PAGE

The Relationship of Reading Abilities and Basic Skills of the Elementary School to Success in the Interpretation of the Content Materials in the High School — *L. L. Krantz* 97

A Summary of the Intensive Study of Twenty Highly Selected Elementary Women Teachers — *J. C. Gowan* 115

An Experiment in Developing Critical Thinking in Children — *George H. Hyram* 125

Trends in Children's New Year's Resolutions — *Rose Zeligs* 133

The Problem of Pressure in Handwriting — *Theodore L. Harris and G. Lawrence Rarick* 131

Educational Implications of Personnel Inventory of Supervisors, Head Nurses and Staff Nurses in Selected Hospitals — *Mary T. Grivest and John C. Lynch* 179

$7.50 A YEAR | PUBLISHED QUARTERLY | $1.75 A COPY

Published by Dembar Publications, Inc.,
Madison 3, Wisconsin.
Entered as second-class matter October 17, 1938 at the post office at Madison, Wisconsin, under the act of March 3, 1879.

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DEMOCRAT PRINTING COMPANY
MADISON, WISCONSIN

JOURNAL OF EXPERIMENTAL EDUCATION
(Volume 26, December 1957)

THE RELATIONSHIP OF READING ABILITIES AND BASIC SKILLS OF THE ELEMENTARY SCHOOL TO SUCCESS IN THE INTERPRETATION OF THE CONTENT MATERIALS IN THE HIGH SCHOOL

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THE PURPOSE of the present article is to point out to curriculum planners the reading abilities and study skills needing instructional emphasis for immediate and future use. Also indicated are certain knowledges and understandings relative to the matrix patterns in which these abilities and skills tend to operate in the learning process. The present study was designed to find the relationships between measured areas of seventh-grade reading abilities and study skills and the content areas of the high school.[1]

The population consisted of two classes of seventh-grade pupils whose records were obtained from the Austin Public Schools, Austin, Minnesota. The first seventh-grade class tested in 1947 was tested again as eleventh graders in 1952. The second seventh grade was tested in 1949 and again in 1952 when in the ninth grade. The sample of 471 pupils included in the study, consisted of 215 pupils in the first group (7-11) and 256 pupils in the second group (7-9).

Tests used in the study were the California Intelligence Tests (Non-language Section), 1946 Revision, grades 9 to adult; the Iowa Tests of Basic Skills, Form Q and Form R; and the Iowa Tests of Educational Development, Form Y-2.

The reading abilities and work study skills measured by the Iowa Tests of Basic Skills in the Seventh Grade (Independent Variables) were as follows:

Reading Comprehension
Reading Vocabulary
Map Reading
Use of References
Use of Index
Use of Dictionary
Reading Graphs, Tables, and Charts
Total Work Study Skills
Usage (Language)
Spelling
Total Language Skills
Fundamental Knowledge in Arithmetic
Fundamental Operations
Problems
Total Arithmetic

The measures in content areas at high school level, as obtained from scores on the Iowa Tests of Educational Development (Dependent Variables), were as follows:

Understanding of Basic Social Concepts
Background in the Natural Sciences
Correctness and Appropriateness of Expression
Ability to Do Quantitative Thinking
Ability to Interpret Reading Materials in the Social Studies
Ability to Interpret Reading Materials in the Natural Sciences
Ability to Interpret Literary Materials
General Vocabulary
Total of Above
Use of Sources of Information

The seventh grades in the study were found to be homogeneous in respect to the variances. The only exception to homogeneity of the means was found in the case of non-verbal intelligence. The fundamental assumption of a linear relationship between dependent variables and independ-

1. L. L. Krantz. The Relationship of Reading Abilities and Basic Skills of the Elementary School to Success in the Interpretation of the Content Materials in the High School, unpublished Ph.D. dissertation University of Minnesota, 1954.

ent variates was established.

The plan for the statistical analysis was essentially that of zero-order correlation and multiple regression analysis.[2] All zero order correlations were obtained among independent variates as well as between independent variates and dependent variables. Each zero order correlation was tested for statistical significance (from zero). Multiple regression equations involving six independent variables, namely, Non-Verbal Intelligence, Reading Comprehension, Reading Vocabulary, Total Study Skills, Total Language Skills, and Total Arithmetic, were set up on each of the ten areas of content in the high school. A second set of multiple regression equations using five independent variables, namely, Map Reading, Use of References, Use of Index, Use of Dictionary, and Reading Graphs, Tables and Charts, was also set up for each of the ten areas of content in the high school. The above procedure was carried out in both groups to determine the teams of predictors, multiple correlation coefficients, standard errors of estimate, and percentage of variance assignable to each variate. All partial regression coefficients were tested for statistical significance, with those stable at the five percent level of probability (or lower) retained to determine the percentage of assignable variance. A test of the significance of the differences among partial regression coefficients was made in case of each multiple regression equation.

Limitations of the Study

The study possesses certain limitations which should be held in mind while interpreting the findings:

1. The population is that of the seventh grade later becoming the ninth and eleventh grades of Austin Public Schools, Austin, Minnesota. Generalizations to other populations, at any other place or time, may not be warranted.
2. The entire study is limited by the adequacy of measuring instruments employed. Relationships reported are those observed between test scores on specific tests. Generalizations are thus limited by whatever limitations inherent in the tests used.
3. The statistical methods used in the present study are essentially those of correlational analysis. The usual limits and cautions of interpretations of such procedures are to be held carefully in mind.

Summary of Results

The following summary of findings is organized on the basis of the ten areas, on each grade level, to which predictions were made from the seventh grade measures. The essential data are presented in the form of ten tables. Each of the tables carries the name of a dependent variable and names of the predicting independent variates whose regression coefficients were stable at the five percent level (or lower) of statistical significance. The predicting variates are shown for both the ninth grade and the eleventh grade. Next shown in each table is the percentage of total assignable variances attributable to each of the independent variables. The zero order correlation coefficients, the multiple correlation coefficients, and the percentage of total variance accounted for are also shown.

The interpretation of the correlation coefficient was based on a study of the accuracy of its prediction. Of the seventh grade pupils tested in reading and study skills at the seventh grade level, from 69 to 76 percent were found in the same group four years later when tested on the Iowa Test Composite Score. The correlations between the areas tested ranged from .70 to .80. From the results obtained it was decided to designate correlation coefficients of from .70 to .80 'high' and those above .80 'very high' relationships.

In predicting "Understanding of Basic Social Concepts" (see Table I), the combined abilities (Reading Vocabulary, Total Study Skills, Total Arithmetic Skills, Non-Verbal Intelligence) account for 56 percent of the variance at the ninth grade level, whereas the combined abilities (Total Study Skills, Reading Vocabulary, Total Language) account for 53 percent of the variance at the eleventh grade level. Reading vocabulary and total study skills account for most of the accountable variance in both grades. However, total study skills is second in size of contribution to the variance at the eleventh grade level. Reading vocabulary at ninth grade level and total study skills at eleventh grade have zero order correlation coefficients within five points of their multiple correlation coefficients. The two variates can predict the dependent variable with almost as high a relationship as the groups of abilities of which they are a part.

Note: Any comparison between the second half of Table I, entitled Basic Study Skills and Total Study Skills, appearing in the first half of the table, is of a spurious nature. While a separate multiple regression analysis was per-

2. L. L. Krantz. "An Application of Multiple Regression Analysis in Determining the Relative Contribution of Certain Components of Reading Ability in Grade and High School Achievement," Journal of Experimental Education, XXIII (March 1955), pp. 275-77.

TABLE I

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING THE UNDERSTANDING OF BASIC SOCIAL CONCEPTS AT NINTH (Y_1) AND ELEVENTH GRADE (Z_1) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Reading Vocabulary**	68	.70	Total Study Skills**	55	.68
Total Study Skills*	17	.69	Reading Vocabulary**	37	.57
Total Arithmetic*	10	.61	Total Language (-)*	8	.47
Non-Verbal Intelligence*	05	.51			
	100			100	
Total Variance	56.0			53.0	
Multiple R*		.75			.73
BASIC STUDY SKILLS					
Reading Graphs, Tables, and Charts**	57	.67	Map Reading**	48	.62
Map Reading**	43	.66	Use of Index**	36	.60
			Reading Graphs, Tables and Charts*	16	.59
	100			100	
Total Variance	52.0			47.0	
Multiple R**		.72			.69

* Statistically Significant at five percent level.
**Statistically Significant at one percent level.

formed from which to predict the same dependent variable the independent variables used in the matrix were entirely different.

In predicting "Understanding of Basic Social Concepts" (second part of Table I), from basic study skills the combined skills (Reading Graphs, Tables and Charts, and Map Reading) account for 52 percent of the variance at the ninth grade level, whereas, the combined study skills (Map Reading, Use of Index, and Reading Graphs, Tables and Charts) account for 47 percent of the variance at the eleventh grade. Reading Graphs, Tables and Charts, and Map Reading appear to predict at both grade levels, with Map Reading showing consistent strength. The Use of Index appears as a predicting factor at only the eleventh grade level. The best single factor for predicting to eleventh grade level is Map Reading; whereas, Reading Graphs, Tables and Charts, together with Map Reading seem best for grade nine. The differences between zero order correlations and multiple correlations are small; being as little as five points at the ninth grade level and seven points at the eleventh grade level. This indicates, at best, only slightly better prediction by groups of skills than by single variates.

In predicting "Background in Natural Science" (see Table II), the combined abilities (Total Study Skills, Total Arithmetic, Reading Vocabulary) account for 51 percent of the variance at the ninth grade level, whereas, the combined abilities (Reading Comprehension, Non-Verbal Intelligence, Total Language Skills, and Total Study Skills) account for 48 percent of the variance at the eleventh grade. A complete change of pattern for the predicting abilities appears in going from grade nine to grade eleven. Total Study Skills accounts for 68 percent of the assignable variance at the ninth grade but drops to last place in the eleventh grade group with 11 percent. Reading Comprehension is the strongest predictor at the eleventh grade, accounting for 50 percent of the assignable variance. Predicting from the seventh grade is about equally accurate to both the ninth grade and the eleventh grade levels, as indicated by only a two-point difference in Multiple Correlation Coefficients.

In predicting "Background in Natural Science" (see Table II, second part), from basic study skills, the combined skills (Reading Graphs, Tables and Charts, and Map Reading) account for 49 percent of the total variance at the ninth grade level, whereas, Map Reading alone accounts for all the assignable variance, 38 percent, at the eleventh grade. Apparently, Map Reading could be used to predict this achievement at both grade levels, but is considerably stronger at ninth grade level.

In predicting "Correctness and Appropriateness of Expression" (see Table III), Total Language Skills, Reading Vocabulary, Non-Verbal Intelligence account for 75 percent of the variance at the ninth grade level, whereas, Total Language and Non-Verbal Intelligence account for 63 percent of the variance at the eleventh grade. Total Language ability accounts for the major portion of the variance at both grade levels and has zero order coefficients of correlation nearly as large as the multiple correlation coefficients. The variates appear to predict somewhat more accurately at the ninth grade than at the eleventh grade as indicated by a higher multiple correlation and amount of variance accounted for. These differences are not large, however, and correlations at both levels are quite high. Reading vocabulary does not enter into the prediction at the eleventh grade.

In predicting from basic study skills to "Correctness and Appropriateness of Expression" (see second part of Table III), two skills (Use of Dictionary and Use of Index) account for 64 percent of the variance at the ninth grade level, and 55 percent of the variance at the eleventh grade level. The multiple correlation coefficient is only two points higher than the zero order correlation for Use of Dictionary at both ninth and eleventh grade.

In predicting "Ability to Do Quantitative Thinking" (see Table IV), three abilities (Total Arithmetic, Total Study Skills, and Non-Verbal Intelligence) account for 62 percent of the variance at the ninth grade level, whereas, two abilities (Total Arithmetic and Non-Verbal Intelligence) account for 63 percent of the variance at the eleventh grade level. Total Arithmetic is the best single predictor at both levels. Again it is observed that the highest zero order correlations are about as high as the multiple R's.

In predicting from basic study skills to the "Ability to Do Quantitative Thinking" (second part of Table IV), Map Reading and Reading Graphs, Tables and Charts account for 54 percent of the variance at the ninth grade and 50 percent of the variance at the eleventh grade. Both skills have about the same high degree of relationship with the dependent variable and predict about equally well to both grade levels. Map Reading alone predicts about as well at both levels as do the combined measures in multiple regression equations.

In predicting "Ability to Interpret Reading Materials in the Social Studies" (see Table V), three abilities combine (Reading Vocabulary, Reading Comprehension, Total Study Skills) to account for 69 percent of the variance at the ninth grade level, whereas, two abilities (Reading Comprehension, Total Study Skills) account for 68 percent of the variance in grade eleven. The two sets of abilities predict about equally as well to both grades.

In predicting from basic study skills to the

TABLE II

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING BACKGROUND IN NATURAL SCIENCE AT NINTH (Y_2) AND ELEVENTH-GRADE (Z_2) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Total Study Skills**	68	.69	Reading Comprehension**	50	.62
Total Arithmetic**	17	.61	Non-Verbal Intelligence**	22	.55
Reading Vocabulary*	15	.63	Total Language Skills**	17	.37
			Total Study Skills*	11	.58
	100			100	
Total Variance	51.0			48.0	
Multiple R*		.72			.70
BASIC STUDY SKILLS					
Reading Graphs, Tables, and Charts**	51	.65	Map Reading**	100	.61
Map Reading**	49	.65			
	100			100	
Total Variance	49.0			38.0	
Multiple R**		.70			.61

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

TABLE III

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING CORRECTNESS AND APPROPRIATENESS OF EXPRESSION AT NINTH (Y_3) AND ELEVENTH GRADE (Z_3) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Total Language**	89	.85	Total Language**	90	.77
Reading Vocabulary**	9	.76	Non-Verbal Intelligence**	10	.52
Non-Verbal Intelligence*	2	.63			
	100			100	
Total Variance	75.0			63.0	
Multiple R*		.86			.79
BASIC STUDY SKILLS					
Use of Dictionary**	79	.78	Use of Dictionary**	79	.71
Use of Index**	21	.71	Use of Index**	21	.63
	100			100	
Total Variance	64.0			55.0	
Multiple R**		.80			.74

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

TABLE IV

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING ABILITY TO DO QUANTITATIVE THINKING AT NINTH (Y_4) AND ELEVENTH GRADE (Z_4) LEVEL

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Total Arithmetic**	50	.73	Total Arithmetic**	75	.75
Total Study Skills**	42	.73	Non-Verbal Intelligence**	25	.65
Non-Verbal Intelligence**	8	.58			
	100			100	
Total Variance	62.0			63.0	
Multiple R**		.79			.79
BASIC STUDY SKILLS					
Map Reading**	54	.68	Map Reading**	62	.66
Reading Graphs, Tables and Charts**	46	.67	Reading Graphs, Tables and Charts**	38	.63
	100			100	

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

TABLE V

A SUMMARY OF ZERO* ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING ABILITY TO INTERPRET READING MATERIALS IN THE SOCIAL STUDIES AT NINTH (Y_5) AND ELEVENTH GRADE (Z_5) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Reading Vocabulary**	52	.79	Reading Comprehension**	54	.78
Reading Comprehension**	24	.75	Total Study Skills**	46	.77
Total Study Skills**	24	.76			
	100			100	
Total Variance	69.0			68.0	
Multiple R**		.83			.82
BASIC STUDY SKILLS					
Reading Graphs, Tables and Charts**	53	.72	Reading Graphs, Tables and Charts**	32	.68
Use of Dictionary**	47	.72	Use of Index**	31	.67
			Map Reading**	19	.64
			Use of Dictionary**	18	.65
	100			100	
Total Variance	61.0			58.0	
Multiple R		.78			.76

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

"Ability to Interpret Reading Materials in the Social Studies" (see second part Table V), two skills (Reading Graphs, Tables and Charts, Use of Dictionary) account for 61 percent of the variance in the ninth grade, whereas, four skills (Reading Graphs, Tables and Charts, Use of Index, Map Reading, Use of Dictionary) account for 58 percent of the variance at the eleventh grade level. Prediction is about equally accurate at both levels. Reading Graphs, Tables and Charts, appears to be the strongest predictor at both levels. Several of the zero-order correlation coefficients are about as high as the multiple R's.

In predicting "Ability to Interpret Reading Materials in Natural Sciences" (see Table VI), a group of abilities (Reading Vocabulary, Read-Comprehension, Total Language) account for 59 percent of the variance in the ninth grade; Reading Comprehension and Non-Verbal Intelligence account for 64 percent of the variance at the eleventh grade. Reading Vocabulary shows stronger predicting power to the ninth grade, while Reading Comprehension is the best at the eleventh grade level. These same two variables yield zero-order correlation coefficients about as high as the multiple R's.

In predicting from seventh grade basic study skills to "Ability to Interpret Reading Materials in Natural Sciences" (second part Table VI), three study skills (Use of Dictionary, Reading Graphs, Tables and Charts, Use of References) account for 49 percent of the variance at the ninth grade, whereas, a different combination (Map Reading, Use of Dictionary, Reading Graphs, Tables and Charts) account for 49 percent of the variance at the eleventh grade. The two groups of study skills appear to predict with equal ability at the two levels.

In predicting "Ability to Interpret Literary Material" (see Table VII), three abilities (Reading Comprehension, Reading Vocabulary, Total Language) account for 61 percent of the variance in the ninth grade, and the same three account for 58 percent of the variance at the eleventh grade. The high zero-order coefficients indicate that Reading Vocabulary and Reading Comprehension offer nearly as good prediction on an individual basis as with the group. Prediction is about equally accurate over a two-year period as over the four-year period.

In predicting from basic study skills to "Ability to Interpret Literary Material" (see second part Table VII), three skills (Use of Dictionary, Reading Graphs, Tables and Charts, Use of Index) account for 55 percent of the variance at the ninth grade; two skills (Use of Index, Use of Dictionary) account for 37 percent of the variance at the eleventh grade. There is a definite loss in predicting power from the two to the four year span of time for this dependent variable. The Use of Dictionary is the best consistent predictor over the two- and four-year span. Several of the zero order coefficients of correlation are about as high as the multiple R's at both levels.

In predicting "General Vocabulary" (see Table VIII), two abilities (Reading Vocabulary, Total Language) account for 63 percent of the variance at the ninth grade level, whereas, Reading Vocabulary, Total Language and Reading Comprehension account for 67 percent of the variance at the eleventh grade. Prediction is about equally accurate for the two-year and four-year span periods. The best single predictor at both grade levels, as indicated by size of correlation coefficients, is Reading Vocabulary. The zero-order r's provided by Reading Vocabulary also may, for all practical purposes, be regarded as just as high as the R's.

In predicting from basic study skills to "General Vocabulary" (see second part Table VIII), three study skills (Use of Dictionary, Reading Graphs, Tables and Charts, Use of References) accounts for 48 percent of the variance at the ninth grade level whereas Use of Index and Use of Dictionary account for 51 percent of the variance at the eleventh grade. The Use of Dictionary appears to be a strong predicting skill at both levels.

In predicting "Total Tests 1-8" (see Table IX), all abilities (Reading Vocabulary, Total Study Skills, Reading Comprehension, Total Language, Total Arithmetic, Non-Verbal Intelligence) account for 80 percent of the variance in the ninth grade, whereas five abilities (Reading Comprehension, Non-Verbal Intelligence, Total Study Skills, Reading Vocabulary, Total Arithmetic) account for 76 percent of the variance at the eleventh grade as at the ninth grade level. Reading vocabulary is most highly related at the ninth grade, while Reading Comprehension shows the best relationship at the eleventh grade level with this dependent variable.

In predicting from basic study skills to "Total Tests 1-8" (see second part Table IX), three skills (Use of Dictionary, Reading Graphs, Tables and Charts, and Map Reading) account for 70 percent of the variance, whereas four skills (Map Reading, Reading Graphs, Tables and Charts, Use of Index, and Use of Dictionary) account for 63 percent of the variance at the eleventh grade. The Use of Dictionary at the ninth grade level, and Map Reading at the eleventh grade appear to account for the greater portion of the variance.

In predicting "Use of Sources of Information" (see Table X), Total Study Skills ans Total Language account for 63 percent of the variance at the ninth grade level, whereas Total Study Skills and Non-Verbal Intelligence account for 49 percent of the variance at the eleventh grade level.

TABLE VI

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING ABILITY TO INTERPRET READING MATERIALS IN NATURAL SCIENCES AT NINTH (Y_6) AND ELEVENTH GRADE (Z_6) LEVELS

Grade Nine			Grade Eleven		
Independent Variates	Percent Var.	r	Independent Variates	Percent Var.	r
Reading Vocabulary**	48	.73	Reading Comprehension**	83	.76
Reading Comprehension**	31	.68	Non-Verbal Intelligence**	17	.59
Total Language**	21	.70			
	100			100	
Total Variance	59.0			64.0	
Multiple R**		.77			.80
BASIC STUDY SKILLS					
Use of Dictionary**	68	.66	Map Reading**	49	.62
Reading Graphs, Tables and Charts**	23	.61	Use of Dictionary**	30	.60
Use of References**	9	.52	Reading Graphs, Tables and Charts**	21	.62
	100			100	
Total Variance	49.0			49.0	
Multiple R**		.70			.70

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

TABLE VII

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING ABILITY TO INTERPRET LITERARY MATERIAL AT NINTH (Y_7) AND ELEVENTH GRADE (Z_7) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Reading Comprehension**	41	.73	Reading Comprehension**	58	.72
Reading Vocabulary**	39	.73	Reading Vocabulary**	32	.70
Total Language**	20	.70	Total Language**	10	.63
	100			100	
Total Variance	61.0			58.0	
Multiple R**		.78			.76
BASIC STUDY SKILLS					
Use of Dictionary**	78	.71	Use of Index**	50	.56
Reading Graphs, Tables and Charts**	6	.61	Use of Dictionary**	50	.56
Use of Index**	16	.63			
	100			100	
Total Variance	55.0			37.0	
Multiple R**		.74			.61

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

TABLE VIII

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING GENERAL VOCABULARY AT NINTH (Y_8) AND ELEVENTH GRADE (Z_8) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Reading Vocabulary**	86	.78	Reading Vocabulary**	40	.76
Total Language**	14	.71	Total Language**	32	.72
			Reading Comprehension**	28	.74
	100			100	
Total Variance	63.0			67.0	
Multiple R**		.80			.82
BASIC STUDY SKILLS					
Use of Dictionary**	79	.66	Use of Index**	54	.66
Reading Graphs, Tables, and Charts**	15	.59	Use of Dictionary**	46	.65
Use of References**	6	.50			
	100			100	
Total Variance	48			51.0	
Multiple R**		.69			.71

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

TABLE IX

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING TOTAL TESTS AT NINTH (Y_9) AND ELEVENTH GRADE (Z_9) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Reading Vocabulary**	51	.83	Reading Comprehension**	52	.81
Total Study Skills**	17	.83	Non-Verbal Intelligence**	14	.61
Reading Comprehension**	13	.78	Total Study Skills**	13	.80
Total Language**	9	.79	Reading Vocabulary**	13	.74
Total Arithmetic**	6	.72	Total Arithmetic**	8	.74
Non-Verbal Intelligence**	4	.58			
	100			100	
Total Variance	80.0			76.0	
Multiple R**		.89			.87
			BASIC STUDY SKILLS		
Use of Dictionary**	55	.77	Map Reading**	36	.69
Reading Graphs, Tables and Charts**	33	.76	Reading Graphs, Tables and Charts**	26	.71
Map Reading**	12	.71	Use of Index**	22	.68
			Use of Dictionary**	16	.66
	100			100	
Total Variance	70.0			63.0	
Multiple R**		.83			.79

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

TABLE X

A SUMMARY OF ZERO ORDER CORRELATION COEFFICIENTS, MULTIPLE CORRELATION COEFFICIENTS AND ASSIGNABLE VARIANCE PERCENTAGES FOR PREDICTING USE OF SOURCES OF INFORMATION AT NINTH (Y_{10}) AND ELEVENTH GRADE (Z_{10}) LEVELS

Independent Variates	Grade Nine Percent Var.	r	Independent Variates	Grade Eleven Percent Var.	r
Total Study Skills**	46	.76	Total Study Skills**	87	.68
Total Language**	35	.74	Non-Verbal Intelligence**	13	.53
Reading Comprehension**	19	.70			
	100			100	
Total Variance	63.0			49.0	
Multiple R**		.80			.70
			BASIC STUDY SKILLS		
Use of Dictionary**	48	.71	Map Reading**	52	.58
Use of References**	19	.60	Reading Graphs, Tables and Charts**	48	.58
Reading Graphs, Tables and Charts**	18	.67			
Use of Index**	15	.67			
	100			100	
Total Variance	60.0			42.0	
Multiple R**		.78			.65

* Statistically Significant at 5 percent level.
**Statistically Significant at 1 percent level.

The single ability, Total Study Skills, has a zero order correlation approximating the size of the multiple correlation, indicating its ability to predict about as well by itself.

In predicting from basic study skills to "Use of Sources of Information (see second part Table X), four skills (Use of Dictionary, Use of References, Reading Graphs, Tables and Charts, and Use of Index) account for 60 percent of the variance at the ninth grade level. Map Reading and Reading Graphs, Tables and Charts, account for 42 percent of the variance at the eleventh grade. Use of Dictionary appears strongest in prediction at the ninth grade, while Map Reading and Reading Graphs, Tables and Charts share the burden of prediction at the eleventh grade. There appears to be closer prediction at the ninth grade than at the eleventh grade although the difference between the R's was not tested for statistical significance.

A summary of the number of times each independent variate appears in predicting to grade levels nine and eleven is shown in Table XI. The column "Common to Both" indicates the frequency with which the variate predicted the same dependent variable on both grade levels.

In Table XI, Non-Verbal Intelligence makes an independent contribution to the variance in four dependent variables at the ninth grade level, three of the same dependent variables at grade nine and eleven, and six of the dependent variables at grade eleven.

Reading Comprehension contributes to the variance in five of ten dependent variables at the ninth grade level, seven out of ten at the eleventh grade level, and four of the same dependent variables at both levels.

Reading Vocabulary contributes to the variance in eight out of ten dependent variables at the ninth grade level, four out of ten at the eleventh grade level, and four of the same dependent variables at both levels.

Total Study Skills contributes to the variance in six out of ten dependent variables at the ninth grade level, five out of ten at the eleventh grade level, and five of the same dependent variables at both levels.

Total Language Skills contributes to the variance in six out of ten dependent variables at the ninth grade level, five out of ten at the eleventh grade level, and three of the same dependent variables at both levels.

Total Arithmetic Skills contributes to the variance in four out of ten dependent variables at the ninth grade level, two out of ten at the eleventh grade level, and two of the same dependent variables at both levels.

In the Study Skill section of the table, Map Reading contributes to the variance in four out of ten dependent variables at the ninth grade level, seven out of ten at the eleventh grade level, and four of the same dependent variables at both levels.

Use of References contributes to the variance in four out of ten dependent variables at the ninth grade level. It does not appear in the eleventh grade group.

Use of Index contributes to the variance in two out of ten dependent variables at the ninth grade level, six out of ten at the eleventh grade level, and two of the same dependent variables at both levels.

Use of Dictionary contributes to the variance in seven out of ten dependent variables at the ninth grade level and eleventh grade level, but it contributes to six of the same dependent variables at both levels.

Reading of Graphs, Charts and Tables contributes to the variance in nine out of ten dependent variables at the ninth grade level, in five out of ten at the eleventh grade level, and to five of the same dependent variables at both levels.

Conclusions

1. All zero-order relationships among measured reading and study skills in the seventh grade were statistically significant at the one percent level.

2. All zero-order relationships between measured reading and study skills in the seventh grade and each of ten measured abilities in the high school on separate grade levels, nine and eleven were statistically significant at the one percent level.

3. Zero-order r's were about as high as multiple R's. The correlations were very high; exceeding those to be expected from even the best of intelligence tests.

4. The general "verbal achievement tests" such as reading vocabulary and reading comprehension, generally surpassed all others in predictive capacity.

5. There were some reading abilities and skills "specific" to certain areas. For example, language ability was predicted by language skills, total vocabulary by vocabulary, arithmetic ability by arithmetic skills, and use of sources of information by study skills.

6. Predicting measures specific to a content area, held their place in prediction to that area regardless of time span. There was a tendency for some specific skills like language, total arithmetic, and reading comprehension to become stronger in predicting ability over the four-year period.

7. Predictions of high school achievement, as measured in the present study, were generally higher when made from both reading and study skills than from study skills alone.

8. For the type of measurement used in this study there appeared to be little value in break-

TABLE XI

THE NUMBER OF TIMES THAT EACH INDEPENDENT VARIATE ENTERS SIGNIFICANTLY IN MULTIPLE REGRESSION EQUATIONS FOR PREDICTION OF THE DEPENDENT VARIABLES AT GRADE LEVELS NINE AND ELEVEN

	Grade Levels		
	9		11
Independent Variates	No.	Common to Both	
Non-Verbal Intelligence	4	3	6
Reading Comprehension	5	4	7
Reading Vocabulary	8	4	4
Total Study Skills	6	5	5
Total Language Skills	6	3	5
Total Arithmetic Skills	4	2	2
	STUDY SKILLS		
Map Reading	4	4	7
Use of References	4	0	0
Use of Index	2	2	6
Use of Dictionary	7	6	7
Reading of Graphs, Tables and Charts	9	5	5

*The highest possible value for each level of the table is 10.

ing down total study skills for purposes of predicting. This was shown by the fact that the zero-order correlations with high school achievements were about as high as in the case of simple "total" score on study skills as in the case of multiple correlations derived by maximizing the predictive capacities of the several "separate" measures of study skills.

9. Predictions over the four-year span (seventh to eleventh grade levels) were about as accurate as over the two-year span (seventh to ninth grade levels).

10. Reading vocabulary was more closely related to all content areas on the ninth grade level than any other measured ability.

11. Reading comprehension was more closely related to all content areas on the eleventh grade level than any other measured ability.

12. The study skill, use of dictionary, was related from the seventh grade to the same areas of content on both the ninth grade level and the eleventh grade level. The observed relationships appeared stronger on the ninth grade level.

13. Total study skills, reading comprehension, and reading vocabulary were the most "persistent" predictors based on the fact that they predicted the most often to both ninth and eleventh grade levels. However, they frequently entered into combinations with other abilities and skills in predicting to both grade levels.

14. Group skills predicting ninth grade and eleventh grade content areas showed different patterns for all areas except that of ability to interpret literary materials.

15. When the study skills were considered as independent predictors, use of dictionary and reading graphs, charts, and tables were the most persistent, appearing in the greatest number (six out of ten and five out of ten) of predictions to both ninth and eleventh grade levels.

16. The "high specificity" outlook needs further qualifications by reason of the fact that the combinations of measures yielding predictions over the two and four year spans did not always remain constant.

17. The amount of contribution by each reading ability and study skill varied with the content area predicted. No significant difference was found in most instances between the partial regression coefficients when testing for this factor.

18. Achievements in the high school content areas at ninth and eleventh grade levels can be predicted with high accuracy from measures of reading and study skills at seventh grade level. This result confirmed the general claims of the test authors.

19. A low degree of ability was found in predicting success in natural science. Prediction to the area of natural science indicated a lower amount of variance accounted for than in the case of any other dependent variable.

20. The study skills were found to be most highly related to the social studies area.

21. The study skills did not predict reading in natural science. Apparently there were no study skills for this area in the test battery.

22. The vocabulary test of the Iowa Basic Skills Battery with one exception, the content of literary material, did not predict to any content area in the eleventh grade.

Educational Implications

1. Development of reading ability specific to a content area is highly important to pupil achievement in the elementary and secondary school.

2. A knowledge of the different relationships found essential to successful achievement in the content areas of grades nine and eleven should prove of value in planning the curriculum and instructional program.

3. It is imperative that those in charge of teacher education give increased attention to the need for greater depth of knowledge in content fields. Instruction in abilities specific to certain content areas from their early and simple stages to degrees of greater complexity, present a great challenge to the teacher.

4. Research must seek the abilities and basic skills related to the natural science content area. In general, it is highly important to analyze the content fields and find related study skills, as yet unmeasured. Discovery of the skills should result in their inclusion in the educational program.

5. Attention should be directed in the planning of basal reading programs for the provision of instruction in those abilities and skills related to successful achievement in specific content areas.

6. The knowledge of the patterns of reading abilities and study skills used in prediction provide a background for individualized diagnosis.

7. Improved predictions will result if the measuring instruments employed are specific to the content area predicted.

8. The high relationship of the basic skills in map reading, use of index, and use of graphs charts and tables, to social studies content suggests carefully planned instruction in these abilities.

9. The use of the dictionary may be taught as an important skill in nearly all content areas. This does not preclude instruction in the use of the dictionary in the areas of quantitative thinking and natural science although relationships found were low.

10. Tests selected for measurement in the content areas should be specific to the area of measurement. Giving an excessive number of highly related tests yields little to differential

analysis and diagnosis.

11. The present study, using recorded data, should serve to emphasize to educators that need for keeping accurate records on pupil accomplishments over extended periods of time. Valuable information can be obtained, and through research, be used for the improvement of the instructional program.

Suggestions for Further Research

1. There is need for long term experimental studies to test for differential effects of specific instructional procedures. For example, specific instruction in the study skills with subsequent testing of results.

2. A study should be designed to investigate the causes for "achievement shifts" as indicated by certain pupil transfers in the present study from low to high and high to low achievement in the four year period. A study extending over a twelve year span of time may reveal patterns of strength and weaknesses in a school system.

3. The analysis of the content field of natural science is in order to determine the basic skills essential to success in that area. The development and use of tests in this area should be followed by prediction studies similar to the present one.

4. There is need for further research covering the content areas of the present study, but introducing other reading abilities and skills in addition to those found significant.

5. The present study should be repeated for different populations and different grade levels.

JOURNAL OF EXPERIMENTAL EDUCATION
(Volume 26, December 1957)

A SUMMARY OF THE INTENSIVE STUDY OF TWENTY HIGHLY SELECTED ELEMENTARY WOMEN TEACHERS

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I. The Problem and the Procedure

1. Introduction. The Teacher Characteristics Study of the American Council on Education has been engaged in a six-year program to identify characteristic behaviors of teachers. A general description of the work may be found elsewhere (8). This paper is concerned with an investigation in depth by means of interviews and standardized personality tests into the behaviors of a small sample of highly selected elementary women teachers. It seemed reasonable to believe that individual case studies of a small number of outstanding teachers might throw light on the characteristics of such teachers, and might also suggest similarities in background environment and in early relationships to others.

2. Identification of the Criterion Group. Out of a sample of nearly 3000 elementary teachers in Southern California, who had participated in the Teacher Characteristics Study, sixty appeared outstanding in the light of observers' records and were invited to participate. Twenty-five of these agreed to cooperate. Pooled T-score assessments on these teachers are given in Table I. It will be noted that these teachers are considerably above average on each of the three factors identified in the main study and on total assessment. These assessments were based on the ratings of at least two trained observers who saw the teacher independently under normal classroom procedures. It is important to note that while the criterion group is necessarily small it represents some of the most outstanding teachers that could be found in the area.

3. Procedure. Each member of the criterion group was then interviewed for an hour and a half by the writer. The material of the interview was modified from the type indicated in Adorno (1), and covered biographical matters involving, especially, relationships to parents, siblings, home and community, school and job interests. Questions on religious and philosophical attitudes were also asked. Considerable emphasis was placed on feeling tone and insight. Good rapport was secured. The respondents were also given four personality tests to complete at leisure: Guilford-Zimmerman Temperament Survey, California Psychological Inventory (Gough), Allport-Vernon Study of Values (revised), and the Kuder Preference Record (form BM). The rationale for the selection of these tests was, (1) that each was untimed, (2) that each had certain scales concerning which there was much interest in regard to the performance of such a criterion group, and (3) that good control group normative data on normal subjects was readily available.

Of the twenty-five teachers in the original criterion group, only twenty returned test materials, despite the offer to return test scores to respondents. These twenty will be henceforth referred to as "the twenty teachers" or "the criterion group". Data in the remainder of this paper concern this group exclusively.

II. Interview Results

1. General Description of the Criterion Group. Some general statistics regarding this highly selected sample of effective teachers may be of interest. Some of the numerical facts have been incorporated into Table II. Others are presented here.

All ages are represented, the youngest being 22, the median age 39, and the eldest 56.

It was the subjective impression of the interviewer that these teachers were better groomed and better appearing than the average.

Of the twenty, six were born in California, three in Kansas, two in Oregon, and one each in Arizona, Iowa, Illinois, Indiana, Ohio, Missouri, North Dakota, Pennsylvania, and Utah.

Their college training included six from UCLA, one each from Occidental, Redlands, Whittier,

*This research was undertaken by the writer while employed as a staff member of the teacher Characteristics Study, a project of the American Council on Education and the Grant Foundation.

TABLE I

OBSERVERS' ASSESSMENTS ON ORIGINAL TWENTY-FIVE TEACHERS

Category	Factor X	Factor Y	Factor Z	Total
Mean T-score	65.6	63.7	63.7	67.9
Sigmas Above Mean	1.58	1.37	1.37	1.79
Corresponding Percentile	94	91	91	97

TABLE II

STATISTICS COMPILED FROM INTERVIEWS OF TWENTY SELECTED TEACHERS

Variable	Percentile					Approximate Sigma*
	05	15	50	85	100	
1. Age in Years	22	25	39	48	56	11.5
2. Height in Inches	61	61	65	67	68	3.0
3. Weight in Pounds	100	120	135	158	160	19.0
4. Height-Weight Index**	10.5	10.9	12.1	13.1	13.4	1.1
5. Age at Menarche	11	12	13	16	17	2.0
6. Years Resident in California	4	10	16	25	56	7.5
7. Birth Order	1	1	1	3	4	1.0
8. Number of Sibs	1	1	2	4	5	1.5
9. Estimate in thousands of dollars of income adequate for family of four	5	5	6	10	15	2.5
10. Actual number of Natural Children	0	0	0	1	2	.5
11. Number of Children Desired (Ideal Conditions)	0	2	2	4	12	1.0
12. Length of Teaching in Years	2	3	10	25	36	11.0

* Sigma obtained by subtracting raw score for 15th percentile from raw score for 85th percentile and dividing by two.

**Height divided by cube root of weight.

and the old Los Angeles Normal School. Out of state colleges included three on the west coast and the rest midwest normal schools or state colleges. About half had master's degrees, most had taken training beyond the A. B. degree, but none had doctorates.

Fifteen of these women had been married, of which four were divorced. Two of these had remarried.

The present occupation of fifteen teachers was teaching. Three were on maternity leaves; one was on general leave, and one had stopped to become an airline stewardess.

Half of these women were the first born. Of these ten, only three were "only children". Of the remaining ten, five were the last child in the family. In nine cases there were more than two children in the parental family, in five cases more than three children, and in two cases there were five children. There had been parental divorces in two cases, and early death of the father in two other cases.

There were strong teaching traditions in the families of many of these teachers. In eleven cases either the father, mother or both parents had been teachers. In nine cases the teacher parent was the mother; in one case the father and in one case both parents.

Half of these women indicated church membership. In eight of these cases it was the same church as that of the mother, and seven of these cases indicated more than perfunctory interest.

There was positive father-identification in twelve out of the twenty cases, strong mother-identification in twelve cases also, but there were only two cases where there was strong identification with both parents. Permissiveness in one parent, very often the father, was commonly alluded to. The father was indicated as the stronger parent in nine cases, the mother in six cases.

In eleven instances admission was made of a tom-boy stage. There was active group membership while growing up in fourteen cases.

The school record was superior in twelve cases, average in five cases, and below average in three cases. In at least three cases these women, as girls, had skipped grades or had been accelerated. Thirteen of them felt that they had been more scholarly than their classmates in high school, and eleven said that they had dated less. There were instances of early teaching experiences (defined as taking charge of a class in the absence of the regular teacher on one or more occasions before attending college) on the part of nine of the twenty, and in some cases this was surprisingly extensive. One girl taught elementary school when she was seventeen; another had extensive experience as a substitute teacher when still in high school; a third founded and ran her own nursery school while still in high school. There was also much indication that the respondents as children enjoyed playing "school" with peers and that they were the "teachers" by choice or their own insistence.

Of the fifteen married women in the sample, four had one child and two had two children. Three were pregnant with their first children. Because of the youth of many of these teachers, it is obvious that the families of some of them were as yet incomplete. When the fifteen married women were asked how many children they would want in their family, assuming ideal conditions, one said twelve, six said four, five said two, one said none, and two did not respond.

The final interesting statistic in this descriptive section related to the years of experience. Evidently there is little relation between experience and effectiveness. The range was from thirty-six to two years, with the median at ten years. There were six teachers of more than twenty years' experience and six with less than five years.

2. Attitudes Toward Teaching. Turning now to the questionnaire and collating responses in regard to aspects of the vocation, it becomes apparent that the work-libido of these respondents is quite high. To the question "What are the main satisfactions and appeals of teaching?" the following responses were given:

11 Being with children
8 Watching change, growth
3 Changing attitudes
2 Individual differences
1 Dealing with leaders of tomorrow
1 Encouraging progress of children
1 Stimulating pupil reactions
1 Happy accomplishment
1 Fun to meet children
1 Love children
1 Personal contact with children
1 Creative opportunities
1 Enlarging security area
1 Improving emotional atmosphere
1 Eagerness and joy in putting across new ideas

These thirty-five responses were judged as genuine work sublimations. The following responses were judged as not child-centered, but either neutral or negative:

1 Long vacations
1 Nice colleagues
1 No competition
1 Parents grateful
1 Left alone on the job
1 Can do as I wish

In the opinion of the observer, it would be difficult to find this ratio of integration in work-libido

in any other group.

Matters or duties most disliked by these teachers included the following: four disliked clerical work, and one each disliked homework, yard duty, overtime, family difficulties, grading, being rushed, out of school demands, restrictions, and rainy days. It would seem that these teachers want to teach, and that they are especially impatient of clerical work (in which, as we shall see later, they do not excel) and other distractions from their real function.

The members of the group were next asked, "What would you do if you could do anything you wanted to vocationally?" Of the twenty, fourteen would still be teachers, two would write, one each would travel, be at home, be a clothes buyer, and be a professional dancer. (It is the distinct impression of the interviewer that both in test scores and on the criterion the last four were less outstanding teachers than the others. In other words, this question seemed most significant.)

The next question asked was, "What do you expect to be doing ten years from now?" Of the eighteen who responded, two said they expected to retire, two more wished to be raising a family, and fourteen indicated that they expected to be teaching. Asked if they would consider any "upgrading" in education, eight of the group said they would like to be a counselor, six said they would like to be a supervisor, six a dean of women, two a vice-principal, and none a principal or superintendent. Of the twenty only one felt dissatisfied with the amount of money received for teaching. Again, these facts imply a high degree of work interest, and a low degree of power-seeking or status aspiration.

The group tended to maintain a friendly attitude toward administrators. This attitude did not appear to be motivated by a desire to manipulate social pressures to secure advantages. Rather, the tendency seemed to show friendly gregariousness both with respect to the authority figures and to other colleagues whether credentialled or not. In only two cases out of the twenty was there any indication at all of hierarchical thinking as evidenced by an affirmative answer to the question, "Do you think of yourself as a sort of lieutenant carrying out the principal's mandates?" Thirteen out of the group evinced no uneasiness around administrators, and all but two indicated a strong degree of fraternization with peers.

It was practically impossible to get these teachers to project blame. Such questions as "Do any of your associates have it in for you?" "Do children misbehave on purpose?", "Do you associate with children outside class hours?", all drew answers which indicated warmth, trustfulness, and lack of paranoid suspicion to a marked degree on the part of the group. One of the most noticeable characteristics of these teachers is that they do not impute evil motives to others. If there is any blame projection it is introjection.

When the teachers were asked regarding the social value of their work, using such questions as, "What is the most valuable thing a teacher can do for a child?", the answers were uniformly in terms of adjustment, group relations, sense of belonging and personal worth rather than in terms of subject-matter skills. Prevention of delinquency, development of sound attitudes, and development of a sense of values were among other objectives mentioned more than once.

Fourteen out of the twenty teachers thought that they were "cut out for teaching," four were "undecided", and two said "No". Other jobs mentioned as those about which they had dreamed or thought they could handle competently included six responses as writer, five as nurse, four in music, and one each as librarian, secretary, chemist, medical technician, ballet dancer, gardener, and missionary. The only conditions under which any of them would change jobs at present, however, were dictatorial conditions in the schools or the pressing need for money.

Factors affecting decision regarding occupation are important in understanding recruitment problems. Of the twenty, three "always wanted to be teachers", two others decided before high school, five decided in high school (making a cumulative total of ten or half the group who decided before college), three decided in the lower division of college, three in the upper division of college, and, surprisingly enough, four drifted into teaching. Of these last four, two took the teaching credential to please parents, one to be near an eligible male, and one so that she could continue at college.

Besides parents, thirty percent of whom were teachers, there was a large assortment of aunts, cousins, sisters and friends who were teachers and who encouraged the decision. There were five cases in which the encouragement of a particular teacher, or her example, was mentioned as important. In only one case was there any rebellion against parental standards at the time of decision, and parents were uniformly in favor of the choice.

Besides teaching, it is noteworthy that four of these teachers had written and published children's books, and three of them had written and published poetry.

When these teachers were asked what they would do with an annual income of twenty thousand per year, besides the usual personal and ego-involved responses of travel, luxuries and the like in thirteen cases, there were seven cases where an altruistic response was made. Three of these had to do with desire to return to

the university for further study, and the other four had to do with children. These last were to run a private school for gifted children, to send prospective women teachers through college, to help children, and to found a home for war orphans.

3. Family Background. The family backgrounds of these women reveal a well-knit family structure, in which the solidarity of the family is of paramount importance. In only one case was this not true. Annual family vacations and other group family activities were the rule. Music and dancing lessons were provided the respondents by parents in a majority of cases. While money was not abundant in parental homes, and caution in regard to spending it was the rule, there were few financial crises or cases of abject proverty. Nevertheless, most of the teachers, as girls growing up, were expected to provide some share of their "keep", especially by summer work, and by working their way through college for at least part of their expenses. Parents were considered to belong to the upper middle class in most cases, although there was emphasis on "gentility" rather than on wealth. "We didn't have much but we were usually invited everywhere" was characteristic. Parents tended to be club members and to be prominent in church activities. There was also some flavor of literary background evident, e.g., "Father was quite a reader."

Many of these women lived on farms or in small towns as children. They seemed in this way to have developed a sense of social security with regard to the group in which they operated. This is not to say they were socially inclined, for they did not evince the strong interest in social affairs which many women do. If anything, they were on the shy side as children. Even now they enjoy small, informal parties, where things are relatively quiet, instead of noisier activities such as those involving liquor.

Within the home there was rather strong identification with one parent or the other. The parental home was considered to be a happy one in most cases, with relatively few crises and little obvious domination. It was noticeable, however, that there were strong needs on the part of the respondents to conform to parental standards, and this tendency resulted in some idealization of those standards as well as some indications of rigidity and lack of insight into the actual dynamics within the home. Parents were "just wonderful." There was little worry expressed as a child, although some fear of punishment or discipline was noted. In view of the fact that this group tends to "give a good impression" (as seen in the test analysis section) it may be doubted that the picture was in actuality as rosy as here depicted. Nevertheless, it is evident that, in general, strong parental models were present.

4. Religious Interests. This group exhibited a stronger than average interest in religion. Whether this is due to the effect of home background, or to personal experiences (or whether it is an artifact of the "good-impression" tendency noted previously), it is evident that the respondents appear to attract much importance to this area.

Half of the group were church members. Half had come from homes where there was "strict" religious upbringing. There was only one case where neither Sunday School nor early religious participation was noted. Eleven of the group believed the spiritual message of religion to be more important than the social, but only eight felt that active church membership was necessary for salvation. At the present time, six members of the group can be said to be "strict" in the sense of adhering without question to an absolutist type of religion, whereas eleven are nominal in belief, one is unclassified, and two are agnostics. Of the nominal group, three are distinctly liberal in their interpretation of religious values.

With regard to philosophical belief, such as the nature of God, the reason for life on Earth, and kindred questions, seven are conventional in belief, accepting in toto the dogma of their church, three are scientific—potivistic in orientation, three have refined their ontological beliefs to embrace wider views of personal philosophy, and seven have apparently done little thinking in this area. All, however, agree that religious values are an important component of their teaching, although few of them have any understanding of how they actually utilize it in the classroom.

It was the opinion of the interviewer that in many cases these teachers were running on "religious capital" bequeathed them by their parents. In some few cases there seems to have been positive success in securing a philosophy of life wide enough to handle the problems of personal and social responsibility which appeared important to most of them, and to embrace as well the scientific domain of physical reality. In the main, however, there was much conformity evident. Whatever the dynamics, it seemed obvious that they are having success in creating ordered lives for themselves.

5. Community-Social Relations. This group of teachers seem to be warmhearted in the sense of being friendly and generally gregarious although they are not as poised and extroverted socially as more impulsive people may be. They enjoy quiet activities with friends, small parties, and a few friends rather than hordes of acquaintances. They object to noisy, drunken, and boorish behavior. As children they participated well in groups. They belonged to inform-

al gangs, and played, for the most part, in sports. There was little history of their being teased by others, and none of being a scapegoat or being rejected by a group. They had a strong sense of personal and group worth, and were members and officers in clubs and other group organizations. Curiously enough, they are not strong sorority people, nor are they entirely in favor of sororities. Their playmates were generally their own age. They never engaged in gang fights or in group attacks on outgroups. Their home was often the focus for the activities of their group. These girls definitely felt that they "belonged", although they were by no means the most popular members of their group.

They liked school very much, and in general had good school records. They liked college better than high school. They were more scholarly, and in their estimation they dated less than other girls. There was no uniformity in regard to best-liked or most-disliked school subject.

These teachers' own ideals of the most effective and least effective teacher are well delineated in their description of the traits of their teachers which they most admired: good personality, a lady, genteel, an adult emotionally, youthful, persistent, not a show-off, democratic, friendly, permissive, shows interest, definite, fair. Their conception of the behaviors of the ideal teacher was much an extension of an ideal parent's functions. Behaviors of disliked teachers were: unfair, yelled, poor methods, stern, partial, strict, arrogant, no interest, ignorant, intolerant, old, and sarcastic. Their conception of the behavior of the antithesis of the ideal teacher was one who showed no interest or who was partial or blame-projecting. There were many more behaviors named in both the positive and negative areas having to do with democratic-permissive attitudes, than with responsible-organizing attitudes on the part of the teacher.

III. Test Results

1. Introduction. This section analyzes the results of four personality tests given to the twenty teachers. The four tests are: (1) Guilford Zimmerman Temperament Survey, (2) California Psychological Inventory, (3) Allport-Vernon Study of Values, and (4) Kuder Preference Record. It was hypothesized that personality behavior which had shown up in the observations and interviews would also be evident on at least some of the test scales. The names of the special scales on these tests are found in Appendix A.

Results of the tests including comparison with norm groups will be found in Table III. This table gives means and standard deviations for the criterion group of twenty teachers, for the norm group for women as printed in the respective manuals (2, 3, 5, 6), and for the nearest comparable control group. For the first three tests this control group consisted of UCLA teaching candidates (4, 7); for the last test it consists of elementary teachers. The standard deviations for the criterion group and for the UCLA control groups are approximations obtained by subtracting the raw score for the 15th percentile from the raw score for the 85th percentile and dividing by two. In the case of the criterion group (since N = 20) these standard deviations can be accurate only to the nearest half unit. An error of half a unit in this standard deviation generally causes about a 10% change in the standard error of the mean.

The extensive data of Table III are arranged with the four tests and scales on successive lines, and followed on each line by the means and sigmas of the criterion group, of the general norm group, and of the most applicable control group. The final columns compare differences of means, standard errors of those differences, and critical ratios of the criterion group versus each of the other two groups. Only those critical ratios (greater than 2.0) in which the 5 percent level of confidence is reached are displayed. A critical ratio found in the first comparison, but not the second, might be interpreted to mean a vocational difference in personality between these teachers and adult women. A critical ratio found in the second comparison, but not the first, might be interpreted to mean a personality difference between the criterion group and teaching candidates in general. A critical ratio found in both comparisons might be interpreted to mean that there is a continuum on this variable grading from the public through teaching candidates to these highly selected teachers.

The results of the test data as interpreted in the table are summarized in the following sections. No difference will be considered significant unless it exceeds the 5 percent level of confidence. No scale or score will be discussed unless it produces significant differences.

2. The Guilford-Zimmerman Temperament Survey. As compared with general norms, the criterion group was more restrained, more emotionally stable, more objective, more friendly, and had better personal relations (more cooperative and agreeable). As compared with the nearest control group (UCLA candidates) the criterion group was less ascendant, less social, more friendly, and had better personal relations. The most significant difference was on personal relations which showed the largest critical ratio in the entire battery.

3. California Psychological Inventory. As compared to the general norm group of college women, the criterion group was more tolerant, less feminine, had personalities which resulted in higher high school academic achieve-

TABLE III

MEANS, STANDARD DEVIATIONS, DIFFERENCES OF MEANS, STANDARD ERRORS, AND CRITICAL RATIOS OF TWENTY TOP TEACHERS COMPARED WITH THOSE OF TWO NORM GROUPS ON FOUR PERSONALITY TESTS

Test Scale	20 Top Teachers Group I Mean	σ*	General Norm Group II Mean	σ	Nearest Control Group III Mean	σ	Differences of Means I vs. II Diff.$_m$	SE$_d$	CR	Differences of Means I vs. III Diff.$_m$	SE$_d$	CR
G-Z[1]	(N=20)		(N=389)[2]		(N=337)[3]							
G	16.5	7.5	17.0	5.2	17.0	5.0	- 0.5			- 0.5		
R	19.8	5.0	15.8	4.7	18.0	4.5	+ 4.8	1.2	+ 4.0	+ 1.8		
A	13.3	5.5	13.7	5.5	16.6	5.5	- 0.4			- 3.6	1.3	-2.8
S	19.4	6.5	19.6	6.3	22.5	5.5	- 0.2			- 3.1	1.5	-2.0
E	22.7	3.5	15.5	5.8	22.0	4.8	+ 7.2	.83	+ 8.7	+ 0.7		
O	21.9	5.5	16.8	5.4	21.5	5.0	+ 5.1	1.2	+ 4.2	+ 0.4		
F	22.0	4.5	15.7	4.8	18.0	4.5	+ 6.3	1.0	+ 6.3	+ 4.0	1.1	+3.7
T	17.6	5.0	18.1	4.7	17.7	5.2	- 0.5			- 0.1		
P	24.7	2.5	17.0	4.9	21.5	5.8	+ 7.7	.61	12.5	+ 3.0	.64	+4.7
M	12.7	4.0	10.8	4.1	15.1	5.1	+ 1.9			- 2.4		
CPI[11]	(N=20)		(N=175)[12]		(N=415)[13]							
Re	34.2	3.0	32.7	4.0	34.1	4.0	+ 1.5			+ 0.1		
To	28.5	4.0	24.0	4.2	27.1	4.0	+ 4.5	.95	+ 4.7	+ 1.4		
Fl	11.2	4.5	11.7	3.7	11.6	3.5	- 0.5			- 0.4		
St	22.4	3.5	21.4	3.7	23.5	3.0	+ 1.0			- 1.1		
Do	28.2	6.0	27.2	6.4	30.7	5.0	+ 1.0			- 2.5		
Sp	24.6	3.5	24.5	4.8	27.5	4.5	+ 0.1			- 2.9	.81	-3.6
Fe	21.4	2.0	22.7	2.9	20.5	4.0	- 1.3	.50	- 2.6	+ 0.9		
De	15.0	3.5	15.1	4.2	14.2	4.5	- 0.1			+ 0.8		
Ie	42.2	5.0	40.4	4.6	43.5	4.0	+ 1.8			- 1.3		
Ac	31.0	2.0	28.8	3.8	31.4	3.8	+ 2.2	.52	+ 4.2	- 0.3		
Hr	24.6	3.5	21.2	4.0	23.5	3.0	+ 3.4	.83	+ 4.1	+ 1.1		
X_1	35.5	6.5	36.5	5.8	39.3	5.0	- 1.0			- 3.8	1.5	-2.5
X_2	14.1	7.0	19.8	7.1	16.9	7.0	- 5.7	1.7	- 3.4	- 2.8		
In	02.6	1.0	02.6	2.0	02.5	2.0	0.0			- 0.1		
Gi	21.9	8.5	17.7	6.0	21.7	7.0	+ 4.2	2.0	+ 2.1	+ 0.2		
Ds	03.9	3.5	07.4	4.3	04.3	3.0	- 3.5	.84	- 4.1	- 0.4		
Allport[21]	(N=20)		(N=965)[22]		(N=1066)[23]							
The	38.3	8.0	36.4	7.5	38.0	7.4	+ 1.9			+ 0.3		
Eco	36.4	7.0	38.8	7.5	36.4	7.6	- 2.4			0.0		
Aes	38.0	9.5	42.2	8.7	43.4	8.4	- 4.2	2.1	- 2.0	- 4.6	2.1	-2.2
Soc	40.3	11.5	41.3	7.0	41.3	7.0	- 1.3			- 1.0		
Pol	36.2	6.0	38.1	6.1	38.6	6.5	- 1.9			- 2.4		
Rel	44.0	14.0	43.2	10.5	40.9	9.9	+ 0.8			+ 3.1		
Kuder[31]	(N=20)		(N=1429)[32]		(N=40)[33]							
Mech	42.5	15.5	52.7	17.0	49.2	20.1	-10.2	3.4	- 3.4	- 6.7		
Comp	23.1	9.5	31.8	11.6	31.2	12.2	- 8.7	2.1	- 4.2	- 8.1	2.8	-2.9
Scie	47.7	12.0	54.7	14.7	51.5	14.5	- 7.0	2.7	- 2.6	- 3.8		
Pers	63.8	15.5	61.5	17.0	53.4	12.6	+ 2.3			+10.4	4.0	+2.6
Arti	58.4	12.5	53.4	16.1	61.6	14.2	+ 5.0	2.8		- 3.2		
Lite	58.5	15.5	52.6	15.7	57.4	13.9	+ 5.9	3.4		+ 1.1		
Musi	23.0	9.5	21.5	9.2	25.3	9.2	+ 1.5			- 1.8		
So S	93.0	23.5	81.4	18.8	80.3	20.1	+11.6	5.2	+ 2.2	+13.3	6.0	+2.2
Cler	43.1	11.5	62.3	16.8	54.8	18.0	-19.2	2.6	- 7.4	-11.7	3.7	-3.2

*Estimated from percentiles

[1]Guilford-Zimmerman [2]cf Manual, p. 7 [3]UCLA women

[11]California Psychological Inventory [12]college women [13]UCLA norms

[21]Allport-Vernon (Revised) [22]cf Manual p. 9 [23]UCLA women

[31]Kuder Preference Record [32]cf Manual p. 12 [33]teachers, cf Manual p. 12

For names of scales, see Appendix A, available from author.

ment, and the college honor point ratio, was less impulsive and more controlled, tried to give a better impression of themselves, but dissembled less. In many respects, the criterion group resembled the UCLA control group rather strikingly on this inventory. They were, however, less socially participating, and less poised.

4. Allport-Vernon Study of Values. This inventory had little discriminatory power. The criterion group was less aesthetic than both the general norm group and the control group.

5. Kuder Preference Record. As compared with the general norm group the criterion group was less interested in Mechanical, Computational and Scientific areas, more interested in Social Service, and much less interested in Clerical. This latter was the second highest critical ratio in the battery. As compared with elementary teacher controls, the criterion group was less interested in Computational, more in Persuasive, more in Social Service, and less in Clerical matters. The criterion group was almost exactly in line with the median profile for a group of 26 nursery school teachers as given in the Kuder Manual (6:16).

IV. Discussion and Interpretation

1. The Background Producing Outstanding Teachers. Although twenty cases is a small number on which to generalize, it is possible to make certain inferences with regard to the sociological climate which produced these highly selected teachers. Among the many facts, the following appear to stand out most clearly.

An outstanding teacher is the social legacy of a good home. There are in her background certain determinants of behavior, such as responsibility, conformity, lack of blame projection, and cooperativeness in helping others which seem to stem from strong parental models. These parental models were often either teachers themselves or their influence was reinforced by a strong religious atmosphere in the home. There was a positive attitude towards education built up in the minds of the developing subjects by the example of other relatives and friends who either were teachers or who eulogized the teaching profession. There was home stress on "doing well at school" and a strong desire on the part of the subjects as girls to conform to this approved pattern.

There was permissiveness and love with resultant identification for at least one parent in almost every instance. The family seemed to be close-knit, and to do things together. Both in their family groups and in their social groups most of these teachers as girls felt a strong sense of "belonging". They had been under the necessity of conforming in their homes to a standard of conduct which was ordered and "genteel", but certainly neither capricious nor impossible to attain. There seemed to be early development of participative responsibilities to the family group, and then outward toward other social groups. In this development the school, and in many cases, the church seemed to become extensions of the family in the similarity of values approved, and the lack of any alienation perceived by the respondents.

Members of the criterion group showed early and continuing interest in teaching, and this interest was often further incited by early teaching experiences. They were literary, enjoying reading and writing, and generally more scholarly than their peers. They were usually shyer, and dated less as adolescents. They were friendly and cooperative, being intra-punitive rather than extra-punitive, but they were not gregarious in the ebullient social sense. They were more dedicated, "concerned", and usually more controlled in behavior. They are less ascendant in face-to-face situations, but have excellent personal relations, and are emotionally very stable. They tend to give good impressions of themselves. This finding may be a function of ego-strength or it may be due to the fact that they have good impressions of everyone else with virtually no blame projection. They have low clerical and computational interests. They evince a genuine love for children, and for the interpersonal relations which result in the growth and development of children socially and emotionally. They have a strong work-libido and lack orientation towards either money or power. They appear, in short, to be democratically oriented, in the best sense of the term, and enjoy the actual process of personal interaction with children which they conceive to be the real function of teaching.

V. Summary

Twenty outstanding women elementary teachers were identified from a population of several thousand who had been visited and observed in class by two or more trained, competent observers. The selected teachers cooperated in an hour and a half biographical interview, and also completed four personality tests: Guilford-Zimmerman Temperament Survey, California Psychological Inventory, Allport-Vernon Study of Values, and the Kuder Preference Record.

An attempt was made to determine (1) what, if any, aspects in their parental, social, and cultural relationships as children had contributed to their success as teachers, and (2) whether observed teaching behavior was related to any significant group deviations from norms on the inventories. Conclusions inferred were: (1) that there was ample evidence that home

backgrounds of the teachers were favorable, and (2) that distinct personality and interest differences were noticeable.

The most significant group differences appeared in parental teaching incidence and in responsibility, conformity, and social cooperativeness in the developing child. On inventory scales these findings were confirmed by significant deviations in the direction of better personal relations, emotional stability and the like, and in lower clerical and computational interests.

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JOURNAL OF EXPERIMENTAL EDUCATION
(Volume 26, December 1957)

AN EXPERIMENT IN DEVELOPING CRITICAL THINKING IN CHILDREN

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The Problem

EVIDENCE OF the need for improved habits of thinking in both adults and children may be found abundantly not only in the attempts of such individuals to solve the problems of daily living (1, 2, 3), but also in an analysis of the democratic way of life. Such an analysis makes it clear that inasmuch as the ultimate directive force is the will of the people, the answers to the problems of a democratic society have to be discovered by the people themselves. Thus it follows that the people in such a society must be trained to think accurately (4).

This study represents an attempt to meet the above need. In general, the problem of this experiment was to improve the ability of upper grade children in the elementary school to think logically and therefore critically. More specifically, this problem became a study of the effectiveness of a specially designed instructional procedure in accomplishing the above general purpose.

Principles and Basic Assumptions

Many psychologists have correctly concluded that the principles of logic provide only conceptual models of correct thinking rather than psychological characterizations of this basically mental process. At the same time, there is general agreement that research has presented little, if any, objective evidence as to what psychological processes are involved in the act of thinking. The most satisfactory descriptions of this kind seem to be limited to conclusions that thinking is a very complex and very probably disorderly mental activity having little in common with logical rules and principles (5).

From this point of view, it is widely inferred that no matter what experiences one undergoes, his "psychology" of thinking remains essentially unaltered; it is still a tendency toward disorderly and random mental activity directed in a kind of trial-and-error approach to the solution of some problem of which the thinker is cognizant. Thus it would appear that the more meaningful and attainable educational goal with regard to thinking is that of developing attitudes that are conducive to thinking rather than increased understanding and mastery of the rules and principles of logic (5).

To the writer, the fact that thinking does not appear to be inherently logical is of little significance with regard to the possibility that it can be developed into characteristically logical patterns through experience and habit formation.

In the endeavor to set up criteria for both the selection of content material and the development of teaching methods, the following assumptions were posited as basic principles and served as guiding hypotheses:

1. That thinking is critical when it is essentially logical.

2. That logical thinking is no more than the application of the rules of logic to factual data in order to arrive at valid as well as true conclusions (6).

   It follows from this assumption that an individual's growth in the ability to do logical thinking must depend upon his acquiring a working knowledge of the basic rules of logic (7).

3. That children in the upper grades of the elementary school are, in general, mentally capable of acquiring the necessary understanding of logic and a proficiency in the use of its rules (8, 9, 10, 11).

4. That the most effective way of helping children to acquire the necessary working knowledge of the principles of logic is through direct instruction (12, 13).

5. That this direct instruction should consist of:
   a. Materials and learning content which embody the principles of logic. I**

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**All footnotes will be found at end of article.

b. Teaching methods that provide full opportunity for the pupil to discover for himself these principles and to formulate them as generalizations (14).

In order that the writer's position with regard to the nature of logical reasoning might be made more clear, the following definition was postulated:

> Reasoning, whether logical or autistic thinking, consists essentially of those mental activities which: 1. seek to infer valid implications; 2. attempt to demonstrate; or 3. try to systematize knowledge both deductively and inductively (15). The degree to which it accomplishes these purposes is the extent to which it is logical and therefore critical (16).

Limitations

Several limitations of this investigation were necessary. These were: 1. the voluntary limiting of the experiment to testing the effectiveness of a special instructional procedure, and 2. the involuntary limitations imposed by: (a) the inherent difficulties in constructing an original test of reasoning ability; (b) the very small number of children in the upper grades of three public elementary schools with I.Q. ratings of 110 or better; (c) the factor of time which did not permit the repetition of the experimental phase of this study; and (d) the assumptions themselves on which this study is based.

Related Literature

A striking characteristic of much of the research undertaken in the field of the improvement of reasoning ability and of the literature written on the subject is the almost complete absence of the postulates listed above. An equally recurring trait in this literature is the general tendency to identify reasoning with empirical problem-solving or scientific thinking (17, 18, 19).

While research in the field of reasoning is relatively meager in both the scope of its objectives and the number of investigations attempted, it is possible to infer several educationally important conclusions from a survey of the literature. Among the general conclusions that seem to flow from such a survey are the following:

1. That the four purposes which have motivated much of the research in this area have not resulted in widely accepted conclusions. This may be so because:
   a. Efforts to establish experimentally the psychological nature of thinking have yielded no conclusive results.
   b. With regard to the relationship between thinking and other activities, research has shown that thinking and learning are not identical activities (20). However, there is abundant evidence that the logicality of thought is often adversely affected by the emotional state of the thinker (21). Vividness of imagination has been found to be a deterrent rather than an aid to logical thinking (22).
   c. Research into the most effective methods of instruction for promoting growth in reasoning ability has been almost unanimous in the reliance placed by most investigators on pupil activity in problem solving and scientific induction. Except for a very few studies, the teaching of the rules of logic to children as the basis for their mastery of the techniques of correct thinking has been avoided (23).
   d. Efforts to construct valid tests which are suitable for measuring the reasoning abilities of children have not produced entirely satisfactory results (24, 25, 26). There is, then, a rather urgent need for such tests designed specifically for the elementary school.
2. That current instructional practices are not producing satisfactory levels of thinking in pupils (27, 28, 29, 30, 31).
3. That children in the upper grades of the elementary school are mentally capable of developing satisfactory levels of thinking (8).
4. That since the transfer of learning is a distinct possibility, efforts directed towards teaching pupils how to think critically have a lasting educational potential (32).
5. That the primary trait of instruction designed to develop a general reasoning ability in pupils is its provision for pupil growth in the ability to formulate generalizations of the principles of logic.

Procedure

The approach used in the endeavor to realize the objectives of this study was the experimental method. However, inasmuch as the definition of logical reasoning as accepted for this investigation assumed that the necessary cause of growth in the logicality of thought is an either consciously or unconsciously acquired knowledge of the fundamental rules of logic, only the Method of Difference which determines sufficient causes rather than necessary ones was employed[2] (33).

Accordingly, efforts were made to secure and maintain as much control as possible over all pertinent factors, allowing only the instruction of the Experimental Group to serve as the variable. These efforts to establish control consisted of: 1. a program of testing in order to select two equally matched and paired groups, and 2. two programs of instruction in which the only known variable of relevance was the instruction given the Experimental Group in the development of eight broad understandings deemed basic to an adequate concept of logical thinking.

However, three preliminary procedures were were necessary before the efforts of control listed above could be put into effect. First among these steps was the identification of several possible sufficient causes of growth in logical thinking. The necessary cause, it will be remembered, was posited according to the definition of logical thinking as an understanding of, and proficiency in the use of the rules of logic. The following six factors, then, were singled out for control purposes as the possible sufficient causative agents: 1. General Intelligence, because reasoning is a mental activity; 2. Mental Age, because immature mental activity is characterized by its autistic dominance rather than logical; 3. Sex, since physical and perhaps mental maturation occur at varying levels according to sex; 4. Language Ability, because language is the vehicle of thought; 5. Reading Ability, because the very nature of the experimental instructional procedures required that the pupil be able to understand much written material; and 6. Instruction, because the learning of any skill is acquired through some kind of instruction, and because it was through instruction that, hypothetically, the Experimental Pupils could be led to extensive growth in reasoning ability.

A second preliminary step was the development of the experimental instructional procedure. This procedure was envisioned as comprising both content material and teaching methods. The former acquired through an analysis of the understandings deemed necessary to an adequate concept of the nature of logical thinking; the development of the latter grew out of the theory that the most meaningful learnings as well as the most transferable ones are those acquired through self-discovery on the part of the learner and formulated by him into generalizations. Thus, the method employed in the experimental instruction was essentially the Socratic Method and consisted of carefully phrased questions based on simple problems. These questions were designed to lead the pupil to discover a pattern in a series of such problems. Once the pattern had been discerned, the pupil was encouraged to express his insight in the form of a generalization. The method of teaching, then, was primarily inductive in nature.

A third preliminary step leading to control of the experimental procedures was the construction of an original test of general reasoning ability suitable for use with upper grade children of the elementary school. The construction of such a test was considered necessary because available tests do not appear to be adequate for the purposes of this study. The content and skill coverage of this original test were based on the theory that proficiency in reasoning includes not only the ability to infer both inductively and deductively, but also the ability to recognize eductive and analogous thinking as well as the common errors made in reasoning.[3]

In the testing phase of the control efforts, 200 children were measured in five areas: 1. Intelligence, 2. Mental Age, 3. General Reading Ability, 4. General Language Proficiency, and (5) Initial Reasoning Ability. The data secured from these tests made possible the selection of two paired and equated groups of thirty-three children each. Table I shows the statistical significance of the differences between these two groups in the five areas listed above.

The instruction phase of the control efforts was arranged as follows:

1. The writer instructed the Experimental Group in the development of an understanding of the following seven concepts of logical thinking:
   a. The Nature of Thinking in General
   b. The Tools of Thinking
   c. The Nature of Definition
   d. The Nature of Eductive Inference
   e. The Nature of Deductive Inference
   f. The Nature of Experimentation
   g. Common Errors in Reasoning

2. The experimental instruction covered a period of four months of 250 minutes per week.

3. Nine teachers taught that portion of the Control Group which was selected from their respective rooms. The instruction given this group consisted of the regular classroom activities and subject matter content as provided in current Courses of Study of the St. Louis Public Schools. No exposure of the Control Group was permitted either to the content or to the methods employed in the experimental instructional procedure.

Results and Interpretation

At the end of the time allotted, a final test in reasoning was given to both groups and the difference in their mean achievement was tested for significance. The obvious purpose was to determine the effect of the experimental instruction on general reasoning ability.

Through statistical treatment of the data, it

TABLE I

STATISTICAL SIGNIFICANCE OF THE DIFFERENCES BETWEEN THE EXPERIMENTAL AND CONTROL GROUPS EQUATED AND PAIRED ACCORDING TO THEIR RATINGS IN FIVE VARIABLES AND ACCORDING TO SEX

Area	Experimental Group	Control Group
Intelligence	Mean: 106.18 S. D. : 8.82 σ_m : 1.56 σ_{m_D}: 2.516 Standard Error of the Difference: 2.516 Significant Ratio: .036	Mean: 106.091 S. D. : 11.18 σ_m : 1.56
Mental Age	Mean: 168.91 months S. D. : 11.62 σ_m : 2.05 σ_{m_D}: 3.17 Standard Error of the Difference: 3.17 Significance Ratio: .344	Mean: 167.82 months S. D. : 13.70 σ_m : 2.42
General Reading Ability	Mean: 8.61 grade S. D. : .998 σ_m : .176 σ_{m_D}: .261 Standard Error of the Difference: .261 Significance Ratio: .615	Mean: 8.45 grade S. D. : 1.08 σ_m : .193
General Language Ability	Mean: 7.73 grade S. D. : 1.25 σ_m : .21 σ_{m_D}: .309 Standard Error of the Difference: .309 Significance Ratio: .96	Mean: 8.03 grade S. D. : 1.29 σ_m : .23

Continued top of next page...

TABLE I (Continued)

Area	Experimental Group	Control Group
Initial Reasoning Ability	Mean: 41.27 percent S.D. : 8.39 σ_m : 1.47 σ_{m_D}: 2.11 Standard Error of the Difference: 2.11 Significance Ratio: .47	Mean: 40.27 percent S.D. : 8.55 σ_m : 1.51
General Interpretation	Clearly, from these statistics, it is reasonable to assume that the Experimental and Control Groups were indeed equal in the five areas listed above.	

was found that, whereas the two groups had been equal in reasoning ability at the beginning of the study, they were greatly different in achievement in this area on the same test at the end of the experiment. Table II shows the statistical significance of the difference in the mean achievement of these two groups in final reasoning ability.

It was concluded, therefore, that since the only known variable of importance in this sample was the method of instruction, this factor seemed to be a cause sufficient to produce the desired growth in pupil logicality. Additional support for this conclusion was found in the coefficients of correlation between each of the following fac-

TABLE II

SIGNIFICANCE OF THE DIFFERENCE IN FINAL REASONING ABILITY OF THE EXPERIMENTAL AND CONTROL GROUPS

Final Reasoning	
Experimental Group	Control Group
Mean: 72.77 S.D. : 7.78 σ_m : 1.38	Mean: 45.18 S.D. : 7.40 σ_m : 1.31
σ_{m_D}: 1.893	
Standard Error of the Difference: 1.893 Significance Ratio: 14.57	
Interpretation: A significance ratio as large as 14.57 shows clearly that the difference between the two means is statistically significant. Thus, it is highly feasible to conclude that the Experimental Group was superior to the Control Group in final reasoning ability as measured by the original test.	

tors and the final tested reasoning ability of the Experimental Group: 1. I.Q. Levels, 2. Mental Ages, 3. Language Levels, and 4. Reading Levels.

In each case the coefficient of correlation was not statistically significant. This fact seems to indicate that each of the factors initially suspected of being the sufficient cause of pupil growth in the ability to do logical thinking was not a cause at all.

However, an analysis of the correlational scatter diagram revealed that a seventh grade reading level does seem to be the only prerequisite ability for success in learning how to think logically from the type of instruction given in this experiment.

These results and interpretations seem to strengthen the hypotheses which guided the attempts to solve the problem of this investigation. It was concluded, therefore, that there is experimental support for the following assumptions:

1. Correct or logical thinking does depend upon a knowledge of the principles of logic.

2. According to this sample, upper grade pupils can be taught to think critically and therefore logically through the use of instructional procedures which emphasize the principles of logic as the learning content.

Certain implications of educational significance seem to flow from these results and their interpretation as presented above. These implications may be listed as follows:

1. Current teaching methods are insufficient as means of promoting satisfactory growth in the ability to think logically and critically.

2. There is need for the inclusion within the elementary school curriculum provisions for the direct training of pupils in the techniques of logical thinking.

3. Curricular content for the improvement of reasoning ability must include the principles of logic as the basic generalizations to be formulated by pupils.

4. Critical thinking, like the ability to read, spell, write and use numbers, is a tool skill. As such, it cannot be left to develop only through incidental learning experiences.

5. Since there is evidence that a significant growth in logical thinking is not dependent upon language and reading skills alone, it might be inferred that the mere acquisition of factual data through reading does not necessarily lead to increased reasoning power.

6. Greater mastery and insight into, and perhaps, integration of the various subject-matter areas might be attained through "rationalizing" of these subjects. Thus greater attention should be given to pupil application of previously learned techniques of reasoning to problem situations in these subject-matter areas.

7. The acquisition of an understanding of the abstract generalizations inherent in an adequate concept of critical thinking through pupil discovery suggests that perhaps more meaningful concepts of the factual subjects might be developed through instructional procedures which stress the habit of pupil generalization and problem solving.

Recommendations

Although the findings of this study indicate clearly that a knowledge of the principles of logic is basic to proficiency in logical thinking, there is yet need for more conclusive proof of this fact. Such proof might be found in a subsequent experimental study in which the procedures of this investigation are duplicated. Only through such a repetition, constituting the Method of Agreement and Difference, will it be possible to identify experimentally the necessary cause of pupil growth in logical reasoning.

Similarly, it is desirable that the superiority of the teaching method employed in this study be more convincingly demonstrated. This might be accomplished through an entirely different experiment, the only variable of which would be the method of teaching while the learning content consisting of the principles of logic would remain constant. It is recommended, therefore, that:

1. This study in its entirety be duplicated to establish experimentally the assumption that a knowledge of the principles of logic constitutes the necessary cause of pupil growth in critical thinking.

2. An experiment be conducted allowing only the method of instruction to vary while the learning content in both the experimental and control instruction be the principles of logic.

In addition to these general recommendations, it is suggested that the original test of reasoning ability be analyzed statistically in order to determine the difficulty and discriminating power of its items. Following such an analysis, it will be possible to revise and standardize the test in question for ready and meaningful use in all elementary schools.

It is suggested further that a grade placement for the teaching of critical thinking be set up

similar to the following plan:

Grade	Learning Content
7-Low	1. Generalizations leading to an understanding of the nature of logical thinking. 2. Generalizations leading to an understanding of the tools of thinking.
7-High	1. Generalizations leading to an understanding of immediate inference. 2. Generalizations leading to an understanding of the nature of definition.
8-Low	1. Generalizations leading to an understanding of deductive inference. 2. Generalizations leading to an understanding of experimentation.
8-High	1. Generalizations leading to an understanding of the common errors in thinking. 2. Critical analysis of the thinking of others and creative thinking.

Finally, it is suggested that if training in critical thinking is to become an objective of the school to be reached through direct teaching efforts, teachers themselves must become proficient in the knowledge and use of the fundamentals of logic. Such knowledge and proficiency might be acquired more easily through the introduction of basic courses in critical thinking at teacher-training institutions.

While these recommendations might appear sweeping and drastic, it is the considered opinion of the writer that objective evidence justifies at least a serious consideration of them. If steps similar to those outlined in the above recommendations are taken, it is believed that a major effort toward bridging the gap between educational theoretical aims and the actual results of teaching practices will have been made.

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FOOTNOTES

1. The science of logic is but an expression of the real or true relationships existing between things which in themselves are either real or hypothetical. Thus, when one's thinking conforms to logic, it expresses these real relationships and therefore conforms to reality.

2. The reader might recall that there are two types of causes: necessary causes and sufficient causes. The former are factors which are absolutely necessary to the existence of a given phenomenon. The latter are causes which are enough in themselves to bring about a certain effect, but are not always necessary. The following example might clarify this distinction: The cause of a forest fire was a lighted cigarette thrown carelessly in the tall grass. Here the cause is the burning cigarette and the effect is the forest fire. But, there seems to be an added factor which enabled the cause to bring about the effect. This factor is the fact that the cigarette was "thrown into the tall dry grass." It is a quality of the lighted cigarette; thus, it too must be considered as a part of the cause.

   Now, when the question is asked: Does every forest fire have to be caused by a lighted cigarette thrown carelessly into dry grass? —the answer is no. There can be many different causes. The only real necessity is that some combustible object in the forest be raised to its kindling temperature and that it in turn ignite other objects. It is apparent then, that the lighted cigarette or any other spark of fire is merely sufficient as constituent factors to cause the fire. Neither alone is enough to cause the fire. Thus, they are not necessary as causes.

3. A copy of this Original Reasoning Test may be found in Appendix I of the writer's doctoral dissertation, An Experimental Study of Classroom Procedures for Improving the General Reasoning Ability of Upper Grade Pupils, Saint Louis University, St. Louis, Missouri, 1956.

JOURNAL OF EXPERIMENTAL EDUCATION
(Volume 26, December 1957)

TRENDS IN CHILDREN'S NEW YEAR'S RESOLUTIONS

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THE PURPOSE of this study was to gain some understanding of children's daily problems of living and learning in our culture. What difficulties do the children encounter in their struggle for personal growth and social integration? What are their goals for growth? Do they reflect the standards parents and teachers set for them? Do the children feel they are living up to those standards? Do their attitudes show the influence of their peers?

A. The Subjects

The subjects of this study, as shown in Table I, were 32 boys and 28 girls studied in 1945. Their average chronological age was 11 years and 11 months; their average intelligence quotient on the Otis Group Intelligence Test was 105; and their average reading grade equivalent was 6.9 as of May 1945, on the Chicago Reading Test. The subjects studied in 1946 were 22 boys and 29 girls. Their chronological age was 11 years and 7 months; their average intelligence quotient was 106; and their average reading grade equivalent was 7.4. The subjects studied in 1947 were 19 boys and 26 girls. Their average chronological age was 11 years and 6 months; their average intelligence quotient was 125; and their average reading grade equivalent was 10.0. The subjects studied in 1948 were 40 boys and 32 girls. Their average chronological age was 11 years and 5 months; their average intelligence quotient was 125; and their average reading grade equivalent was 10.0. Altogether there were 113 boys and 115 girls, totaling 228 subjects with an average chronological age of 11 years and 7 months; and average intelligence quotient of 115; and an average reading grade equivalent of 8.6. These children attended the sixth grade of a suburban public school in Cincinnati, Ohio. The socio-economic background of the two earlier groups was about average and of the two later groups it was above average.

B. Techniques and Procedures

The day after New Years the children were asked to write down their New Year's resolutions. This technique proved helpful in revealing the daily problems of living with which the children were most concerned.

An analysis of the material suggested the following classification of the children's New Year's resolutions:

1. School
2. Home - parents - conduct
3. Home routines and habits
4. Social relations
5. Health habits
6. Character and personality traits
7. Siblings
8. Food and eating
9. Patriotism

The thirty-two resolutions given most frequently were arranged in the order of frequency.

The individual items were arranged according to frequency and classified under the following headings:

1. Areas Pertaining to the Home
   a. Parents and conduct
   b. Helping parents
   c. Home routines and habits
   d. Sibling relationships
   e. Food and eating
   f. Personal health habits
2. Areas Pertaining to School
   a. Relationship to Teacher
   b. Schoolwork
   c. Conduct
3. Areas Pertaining to Human Relationships
   a. Social relations
   b. Character and personality traits
   c. Patriotism

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TABLE I

CHRONOLOGICAL AGE, INTELLIGENCE QUOTIENT, AND READING ABILITY OF SUBJECTS

Group	Boys	Girls	Total	C.A. in January	I.Q. Otis Group Test	Reading Gr. Equiv. Chicago Reading Test in May
1945	32	28	60	11-11	105	6.9
1946	22	29	51	11- 7	106	7.4
1947	19	26	51	11- 6	125	10.0
1948	40	32	72	11- 5	125	10.0
All Subjects	113	115	228	11- 7	115	8.6

The following basic questions will be discussed in this report:

1. What are the trends in the average number of New Year's resolutions made by 12-year-old boys and girls in 1945 through 1948?
2. What areas of living are of most concern to children of this age?
3. What important resolutions did the children make about their home life?
4. What important resolutions did the children make about their school life?
5. What important resolutions did the children make about character and personality traits, social relations, and patriotism?
6. What specific items were mentioned most often by the children in their New Year's resolutions?
7. What were all the actual New Year's resolutions mentioned by the children?

C. The Findings

Trends in Number of Resolutions Made

The average number of resolutions made by the children from 1945 through 1948 is given in Table II. The highest number of resolutions, 9.98 with an average of 9.14 for the boys and 10.62 for the girls, was made by the children studied in 1946. This was followed by the children studied in 1945 with an average of 8.18 for all subjects, 7.22 for the boys and 9.28 for the girls. Then came the children studied in 1948 with 7.82 for all subjects, 7.65 for the boys and 8.00 for the girls. The children studied in 1947 averaged the smallest number of resolutions with 5.24 for all subjects, 4.47 for the boys and 5.81 for the girls.

In every period studied the girls averaged more New Year's resolutions than the boys. In 1945 the boys averaged 43.7 percent of all resolutions made and the girls averaged 56.3 percent. In 1946 the boys averaged 46.2 percent and the girls 53.8 percent. In 1947 the boys averaged 43.4 percent and the girls 56.6 percent. In 1948 the boys averaged 48.9 percent and the girls 51.1 percent. The averages for all the subjects were 46 percent for the boys and 54 percent for the girls.

These data suggest that the girls probably feel a greater need to conform to the demands of home and school than the boys. These findings may be related to the fact that girls of this age are more mature and more socially aware than boys.

Areas of Living of Most Concern to Children

The children's New Year's resolutions indicated the areas of living of most concern to them. As shown in Table III, arranged according to frequency, the areas were: 1. school - boys 40.1 percent, girls 31.4 percent, and all subjects 35.7 percent; 2. home, parents and conduct - boys 17.0 percent, girls 18.7 percent, all sub-

TABLE II

AVERAGE NUMBER AND PERCENT OF RESOLUTIONS MADE BY BOYS AND GIRLS

Group	Boys	Girls	All Subjects
	Number of Resolutions		
1945	7.22	9.28	8.18
1946	9.14	10.62	9.98
1947	4.47	5.81	5.24
1948	7.65	8.00	7.82
Average	7.24	8.48	7.86
	Percent of Resolutions		
1945	43.7	56.3	100
1946	46.2	53.8	100
1947	43.4	56.6	100
1948	48.9	51.1	100
Average	46.0	54.0	100

TABLE III

AREAS OF MOST CONCERN TO CHILDREN AS INDICATED BY THEIR PERCENT OF NEW YEAR'S RESOLUTIONS

	1945			1946			1947			1948			Total		
	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All
1. School	48.7	35.3	41.5	41.3	33.2	37.3	29.5	23.9	26.7	33.9	31.1	32.5	40.1	31.4	35.7
2. Home, parents and conduct	15.6	21.2	18.4	14.2	17.0	15.6	21.2	20.0	20.6	18.0	18.5	18.2	17.0	18.7	18.0
3. Home routines, and habits	1.7	1.2	1.4	12.0	14.0	13.0	10.6	9.3	10.0	11.7	15.5	13.6	9.0	9.8	9.4
4. Social relations	9.1	10.8	10.0	8.0	7.9	8.0	10.6	6.6	8.6	10.5	6.8	8.6	9.5	8.5	9.0
5. Health habits	3.9	6.9	5.4	12.0	13.0	12.5	6.0	6.6	6.3	7.5	10.0	8.8	7.2	9.8	8.5
6. Character and Personality Traits	8.2	9.6	8.9	6.5	4.5	5.5	6.0	13.2	9.6	7.0	6.6	6.8	7.0	7.8	7.4
7. Siblings	4.3	3.4	3.9	5.7	6.3	6.0	13.0	16.0	14.5	5.5	6.6	6.1	6.0	7.1	6.6
8. Food and eating	1.3	3.1	2.2	2.0	4.5	3.1	3.5	3.3	3.4	5.9	3.9	4.9	3.4	3.8	3.6
9. Patriotism	6.9	10.0	8.5	0.5	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.8	2.4

jects 18.0 percent; 3. home routine and habits - boys 9.0 percent, girls 9.8 percent, all subjects 9.4 percent; 4. social relations - boys 9.5 percent, girls 8.5 percent, all subjects 9.0 percent; 5. health habits - boys 7.2 percent, girls 9.8 percent, all subjects 8.5 percent; 6. character and personality traits - boys 7.0 percent, girls 7.8 percent, all subjects 7.4 percent; 7. siblings - boys 6.0 percent, girls 7.1 percent, all subjects 6.6 percent; 8. food and eating - boys 3.4 percent, girls 3.8 percent, all subjects 3.6 percent; and 9. patriotism - boys 2.0 percent, girls 2.8 percent, and all subjects 2.4 percent.

These figures indicate that school plays a vital role in the lives of these children and is seconded by home, parents, and home routines. This is true for all the groups studied from 1945 through 1948. The children studied in 1945 and 1946 expressed more concern about school than those studied in 1947 and 1948. This may be due to the greater learning difficulties encountered by the first two groups as compared to the last two groups. Table I shows the superiority of the last two groups in intelligence and reading, when compared with the first two groups.

The findings were somewhat reversed in the percent of resolutions about home, with the 1947 children having a slightly larger percent of resolutions about home-parent-conduct, and the 1945 children having a significantly smaller percent of home routines resolutions, 1.4 percent compared to 9.4 percent for all subjects.

In social relations there is very little variation in the trend for the different groups. The least concern about health habits was expressed by the 1945 group, with an average of 5.4 percent of their total number of resolutions, while the 1946 subjects expressed the most concern in this area with an average of 12.5 percent. In character and personality traits the most concern was expressed by the 1947 group with 9.6 percent and the 1945 group with 8.9 percent. Then came the 1948 group with an average of 6.8 percent and the 1946 group with an average of 5.5 percent.

In sibling relations the greatest amount of concern was expressed by the children studied in 1947, with an average of 14.5 percent, while the least concern was expressed by the 1945 group, with an average of 3.9 percent.

There was little variation among the groups in their attitudes about food and eating. The least concern was expressed by the 1945 group with an average of 2.2 percent and the most concern was expressed by the 1948 group with an average of 4.9 percent.

Concern about country and patriotism was shown mostly by the 1945 group with an average of 8.5 percent. There was 0.4 percent for the 1946 group and zero for the others. This can be explained by the influence of the war effort on the children during 1945.

In comparing the boys with the girls these data show that the boys made almost 9 percent more New Year's resolutions about school than the girls. This is a significant difference. The girls averaged slightly higher in all the other areas except in social relations, where they averaged slightly lower than the boys, but these differences were not significant.

The areas of most concern to later childhood, on the whole, maintain the same relative rank for the different groups studied, except that the 1945 group was much less concerned about home routines and habits, health habits, and sibling relationships, while the 1947 group seemed overly concerned about sibling relationships.

In general, there does not seem to be very much change in the trend of children's attitudes, in the areas of living of most concern to them, as expressed by the New Year's resolutions of the groups studied from 1945 through 1948. Any significant differences may be due partly to variations in intellectual and social status.

Resolutions Concerning Home Life

Table IV gives the major activities and relationships that were expressed in the children's New Year's resolutions concerning home life where almost half of the resolutions were centered. Listed under home life were parents and conduct, home routines and habits, sibling relationships, food and eating, and personal health habits. Greatest stress was given to relationship to parents and conduct in the home. Obedience and respect for parents were mentioned most often, with an average of 7.7 percent for the boys, 9.7 percent for the girls, and 8.8 percent for all subjects. Then came helping parents and helping in the home with a 5.8 percent average, and conduct in the home with a 3.4 percent average. The total percent of resolutions concerning parents and conduct in the home was 17.0 for the boys, 18.7 for the girls, and 18.0 percent for all subjects.

Home routines and habits for all subjects averaged 9.0 percent for the boys, 9.8 percent for the girls, and 9.4 percent for all subjects. The children studied in 1945 averaged 1.7 percent for the boys and 1.2 percent for the girls. This is significantly much lower than the averages for the other groups studied. There was little variation between the boys and girls of each group.

In sibling relationships, resolutions about not fighting with sister or brother was mentioned most often. The slower and less able children expressed much less concern about sibling relationships than the brighter and more able children. Thus the 1945 group averaged 4.3 percent

TABLE IV

PERCENTAGES OF RESOLUTIONS CONCERNING HOME LIFE

	1945			1946			1947			1948			Total		
	32 Boys	28 Girls	60 All	22 Boys	29 Girls	51 All	19 Boys	26 Girls	45 All	40 Boys	32 Girls	72 All	113 Boys	115 Girls	228 All
A. Parents and Conduct															
Obedience and respect to parents	7.8	10.0	8.9	7.1	7.5	7.3	8.2	10.2	9.2	6.5	9.0	7.8	7.7	9.7	8.8
Helping parents in the home	3.5	7.2	5.4	4.7	5.2	5.0	4.7	4.6	4.7	7.2	7.0	7.1	5.4	6.1	5.8
Conduct in the home	4.3	4.0	4.2	2.4	2.0	2.2	8.2	4.0	6.1	3.0	2.7	2.9	3.9	2.9	3.4
Total: Parents and Conduct	15.6	21.2	18.4	14.2	17.0	15.6	21.2	20.0	20.6	18.0	18.5	18.3	17.0	18.7	18.0
B. Home Routines and Habits	1.7	1.2	1.5	12.0	14.0	13.0	10.6	9.3	10.0	11.7	15.5	13.6	9.0	9.8	9.4
C. Sibling Relationships															
Not fighting with brother	1.3	0.0	0.7	2.4	2.6	2.5	3.5	4.0	3.8	2.3	4.3	3.3	2.2	2.5	2.4
Not fighting with sister	0.4	1.1	0.8	1.9	3.2	2.6	2.5	6.6	4.5	1.3	2.0	1.6	1.3	2.8	2.1
Other sibling relationships	2.6	2.3	2.4	1.4	0.5	0.9	7.0	5.4	6.2	1.9	0.3	1.1	2.5	1.8	2.1
Total: Sibling Relationships	4.3	3.4	3.8	5.7	6.3	6.0	13.0	16.0	14.5	5.5	6.6	6.1	6.0	7.1	6.6
D. Food and Eating	1.3	3.1	2.2	2.0	4.5	3.3	3.5	3.3	3.4	5.9	3.9	4.9	3.4	3.8	3.6
E. Personal Health Habits															
Biting and picking finger nails	0.0	0.8	0.4	3.3	4.2	3.8	3.5	0.7	2.1	3.0	4.7	3.9	2.3	2.8	2.6
Brushing teeth	0.0	1.2	0.6	1.4	3.0	2.2	1.2	0.0	0.6	1.0	2.7	1.9	0.9	1.6	2.6
Improving posture	0.9	2.3	1.6	0.0	1.0	0.5	0.0	2.7	1.4	0.3	0.0	0.2	0.4	1.2	0.8
Other health habits	3.0	2.9	3.0	7.3	4.8	6.1	1.3	3.2	2.2	3.2	2.6	2.9	3.6	4.2	3.9
Total: Health Habits	3.9	6.9	5.4	12.0	13.0	12.5	6.0	6.6	6.3	7.5	10.0	8.8	7.2	9.8	8.5
Total: Home Life	26.8	35.8	31.3	45.9	54.8	50.4	54.3	55.2	54.8	48.6	54.5	51.6	42.6	49.2	46.1

for the boys and 3.4 percent for the girls in total sibling relationships, while the 1947 group averaged 13.0 for the boys and 16.0 for the girls.

Personal health habits with which the children were concerned included biting and picking finger nails, brushing and caring for teeth, improving posture, and other health habits. In every group the girls averaged more resolutions in this area than the boys. There was much variation among the groups. The 1945 group with an average of 3.9 for the boys and 6.9 for the girls showed the least concern. Next came the 1947 group with an average of 6.0 for the boys and 6.6 for the girls. The 1948 group averaged 7.5 for the boys and 10.0 for the girls. The 1946 group showed most concern, averaging 12.0 for the boys and 13.0 for the girls in personal health habits.

As shown in Table IV, in the total number of resolutions concerning home life, the girls in each group averaged a higher percent of resolutions than the boys. The 1945 group, with an average of 26.8 percent for the boys and 35.8 percent for the girls, and 31.3 percent for all subjects, had a significantly lower percent of resolutions about home life than the other three groups. The 1946 group averages were: boys 45.9 percent, girls 54.8 percent, and all subjects 50.4 percent. The 1947 group averages were: boys 54.3 percent, girls 55.2 percent, and all subjects 54.8 percent. For the 1948 group the averages were: boys 48.6 percent, girls 54.5 percent, and all subjects 51.6 percent. The total resolutions for home life for all the groups were: boys 42.6, girls 49.2, and all subjects 46.1 percent.

Resolutions Concerning School Life

The children's resolutions indicate that school life is of vital importance and concern to them. Table V gives the percent of resolutions the children made about their school life. The major items, according to frequency, deals with schoolwork, conduct in school, and relationship to the teacher. The boys were more concerned than the girls about paying attention to the lessons and working hard to improve in their schoolwork and about other learning factors. In most cases, the girls were slightly more concerned about doing their homework.

The averages for all the groups were: pay attention, work hard, improve in schoolwork, boys 9.7 percent, girls 7.2 percent, and all subjects 8.3 percent; homework, boys 5.7 percent, girls 4.8 percent, and all subjects 5.2 percent; other learning factors, boys 3.6 percent, 3.0 percent, and all subjects 3.5 percent.

The 1945 group showed more concern about their schoolwork than the other groups. Their averages were: boys 25.4 percent, girls 18.0 percent, and all subjects 21.7 percent. The total schoolwork resolutions for all the groups were: boys 19.0 percent, girls 15.0 percent, and all subjects 17.0 percent.

The groups varied in their concern about conduct in school. The 1947 group was least concerned. The averages for conduct in school for all the groups were: boys 14.0 percent, girls 11.4 percent, and all subjects 12.7 percent.

The groups varied somewhat in the percent of resolutions concerned with their relationship to their teachers. In most instances the boys expressed more concern than the girls. The averages for all the groups concerning relationship to teachers were: boys 7.0 percent, girls 5.0 percent, and all subjects 6.0 percent.

The total percent of resolutions about school life shows that this area is of major concern to the children we studied. The 1945 group averages were: boys 48.7 percent, girls 35.3 percent, and all subjects 41.5 percent; the 1946 group averages were: boys 41.3 percent, girls 33.2 percent, and all subjects 37.3 percent; the 1947 group averages were: boys 29.5 percent, girls 23.9 percent, and all subjects 26.7 percent; the 1948 group averages were: boys 33.9 percent, girls 31.1 percent, and all subjects 32.5 percent. Resolutions concerning school life for all the groups averaged: boys 40.0 percent, girls 31.4 percent, and all subjects 35.7 percent. The slow learning children seemed more concerned and the brighter children less concerned about school life. The boys expressed more concern than the girls.

Resolutions Concerning Character and Personality Traits, Social Relations, and Patriotism

Table VI gives the percent of resolutions concerning character and personality traits, social relations, and patriotism. The groups varied somewhat in their total character and personality traits resolutions. The averages for all the groups were: boys 7.0 percent, girls 7.8 percent, and all subjects 7.4 percent.

The groups also varied somewhat in their average number of resolutions concerning social relations. The averages for all the groups were: boys 9.5 percent, girls 8.5 percent, and all subjects 9.0 percent. The need to help their country and show patriotism was expressed mostly by the 1945 group whose averages were: boys 6.9 percent, girls 10.0 percent, and all subjects 8.5 percent. This was probably due to the Second World War.

In the total resolutions concerning character and personality traits, social relations, and patriotism, the 1945 group showed most concern, but when the resolutions about helping country and patriotism are subtracted they do not vary much from the other groups. The total percent or resolutions for this area were: boys 18.5 per-

TABLE V

PERCENTAGES OF RESOLUTIONS CONCERNING SCHOOL LIFE

	1945			1946			1947			1948			Total		
	32 Boys	28 Girls	60 All	22 Boys	29 Girls	51 All	19 Boys	26 Girls	45 All	40 Boys	32 Girls	72 All	113 Boys	115 Girls	228 All
Pay attention, work hard, improve in schoolwork	10.4	8.8	9.6	7.2	6.2	6.7	13.0	6.6	9.8	9.9	7.0	8.5	9.7	7.2	8.3
Do homework	10.0	5.4	7.7	6.9	7.2	7.1	1.2	2.0	1.6	2.6	3.1	2.9	5.7	4.8	5.2
Other learning factors	5.0	3.8	4.4	3.2	2.9	3.1	3.5	2.0	3.8	3.3	3.5	3.4	3.6	3.0	3.5
Total: School Work	25.4	18.0	21.7	17.3	16.3	16.8	17.7	10.6	14.2	15.8	13.6	14.7	19.0	15.0	17.0
Conduct in School	13.8	11.5	12.7	19.2	10.4	14.8	5.9	9.3	7.6	11.5	14.4	13.0	14.0	11.4	12.7
Relationship to Teacher	9.5	5.8	7.7	4.8	6.5	5.7	5.9	4.0	5.0	6.6	3.1	4.9	7.0	5.0	6.0
Total: School Items	48.7	35.3	41.5	41.3	33.2	37.3	29.5	23.9	26.7	33.9	31.1	32.5	40.0	31.4	35.7

TABLE VI

PERCENTAGES OF RESOLUTIONS CONCERNING CHARACTER AND PERSONALITY TRAITS, SOCIAL RELATIONS, AND PATRIOTISM

	1945			1946			1947			1948			Total		
	32 Boys	28 Girls	60 All	22 Boys	29 Girls	51 All	19 Boys	26 Girls	45 All	40 Boys	32 Girls	72 All	113 Boys	115 Girls	228 All
Character and Personality Traits															
Not lose temper	0.3	0.0	0.2	0.0	0.3	0.2	1.3	3.3	2.2	2.0	1.5	1.6	1.0	1.0	1.0
Improve in conduct - be good	3.5	0.3	1.9	0.5	0.7	0.6	0.0	0.7	0.4	1.6	0.0	0.8	1.6	0.5	1.0
Other character and personality traits	4.4	9.3	6.9	6.0	3.5	4.8	4.7	9.2	7.0	3.4	5.1	4.3	4.4	6.3	5.4
Total: Character and Personality Traits	8.2	9.6	8.9	6.5	4.5	5.5	6.0	13.2	9.6	7.0	6.6	6.8	7.0	7.8	7.4
Total: Social Relations	9.1	10.8	10.0	8.0	7.9	8.0	10.6	6.6	6.6	10.5	6.8	8.7	9.5	8.5	9.0
Total: Help Country and Patriotism	6.9	10.0	8.5	0.5	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.8	2.4
Total:	24.2	30.4	27.3	15.0	12.7	13.9	16.6	19.8	18.2	17.5	13.4	15.5	18.5	19.1	18.8

cent, girls 19.1 percent, and all subjects 18.8 percent.

Specific Items Mentioned Most Often by the Children in Their Resolutions

The specific items mentioned by the children were arranged according to frequency and also according to areas pertaining to home, school, and human relationships.

Table VII gives the thirty-two items mentioned most often and arranged according to frequency. These thirty-two items constitute 67.5 percent of all the boys' resolutions and 68.2 percent of all the girls' resolutions, and 67.9 percent of all the resolutions made by all the subjects.

According to Table VII, the resolutions mentioned most often by the children was to improve in conduct in school. Sixty-three percent of the boys, 75 percent of the girls, and 69 percent of all subjects made this resolution. Next came the resolution to improve in schoolwork, made by 71 percent of the boys, 61 percent of the girls, and 66 percent of all the subjects. The third highest resolution was to do homework and have it on time. This was made by 41 percent of the boys and 41 percent of the girls.

Not fight with brother or sister was mentioned by boys 26 percent, girls 46 percent, and all subjects 36 percent. Then came obey parents the first time, boys 22 percent, girls 37 percent, all subjects 30 percent; go to bed early, boys 25 percent, girls 24 percent, all subjects 25 percent; obey my teachers, boys 19 percent, girls 26 percent, all subjects 23 percent; cooperate, help, and respect my teachers, boys 25 percent, girls 16 percent, and all subjects 21 percent. Not nag, annoy, contradict, or argue with parents were mentioned by boys 21 percent, girls 17 percent, and all subjects 19 percent; stop biting my finger nails, boys 15 percent, girls 22 percent, and all subjects 19 percent; obey my mother, boys 9 percent, girls 24 percent, and all subjects 17 percent. Be good, improve in conduct and manners were mentioned by boys 20 percent, girls 14 percent, and all subjects 17 percent; be nice, kind, helpful, friendly to everyone, boys 11 percent, girls 21 percent, and all subjects 16 percent; help around the house, boys 11 percent, girls 19 percent, and all subjects 15 percent.

Other resolutions mentioned by less than 10 percent of the children were, in the order of frequency, get up on time, help my mother, hang up my clothes, improve my conduct toward other people, not lose my temper, help in war effort, do homework promptly, buy defense stamps, have good manners and be polite, cooperate with my friends, help my parents, keep my room in order, brush my teeth twice a day, improve my posture, run errands for my mother, not chew gum in school, not get into fights, and respect and help older people.

The data show that the boys were more concerned than the girls about improving in schoolwork, helping and respecting the teacher, improving in conduct in the home and toward other people, and doing homework promptly. The girls were more concerned than the boys about their conduct in school, about not fighting with siblings, obeying parents the first time, obeying mother, obeying teachers, not biting finger nails, being helpful and friendly to everyone, helping around the house, and hanging up their clothes. The material indicates that the twelve-year-old children we studied are basically concerned with activities and relationships in the school and the home.

Specific Items Mentioned by the Children

Areas Pertaining to the Home—Table VIII gives the specific items mentioned by the children pertaining to the home, arranged according to frequency. Obeying parents the first time they speak, heads the list. This is followed by the resolution not to nag, annoy, sass, or argue with parents, but to respect and help them, to be good in conduct and manners at home, and to help and appreciate and understand the entire family. They resolve to help around the house, wash dishes, run errands, mow the lawn, learn to cook and bake, and take out the garbage.

The need to go to bed early heads the list on home routines and habits. Then come resolutions to get up on time, hang up clothes, do homework promptly, keep room, closets, and dresser drawers in order, make bed, take care of clothes and shoes, come home from school promptly, do everything promptly, not listen to the radio while doing homework or going to bed, getting things ready the night before, and being more neat.

Under sibling relationships, the most frequently given resolution is not fighting with brother or sister. Other items are obeying older sister or brother, helping and not fighting with siblings or not teasing them, taking care of younger siblings, not spoiling them, and not being jealous of siblings.

Eating less and sticking to their diet heads the list under food and eating. Then come the resolutions to eat less candy, eat all foods served on the table, eat a better breakfast, have better table manners, not waste food or be a fussy eater, eat better and more food, and drink four glasses of milk every day. The children also mentioned the need to learn to like new foods, to eat slowly, eat soup, vegetables, cereal, carrots and peas, and to eat better lunches. The data show that some of the chil-

TABLE VII

RESOLUTIONS MENTIONED MOST FREQUENTLY BY THE CHILDREN

Resolution	Percent Boys	Girls	Total
1. Improve conduct in school	63	75	69
2. Improve in schoolwork	71	61	66
3. Do homework and have it on time	41	41	41
4. Not fight with brother or sister	26	46	36
5. Obey parents the first time	22	37	30
6. Go to bed early	25	24	25
7. Obey my teachers	19	26	23
8. Cooperate, help, and respect my teachers	25	16	21
9. Not nag, annoy, contradict, or argue with parents	21	17	19
10. Stop biting my finger nails	15	22	19
11. Obey my mother	9	24	17
12. Be good - improve in conduct and manners at home	20	14	17
13. Be nice, kind, helpful, friendly, to everyone	11	21	16
14. Help around the house	11	19	15
15. Get up on time	8	10	9
16. Help my mother	6	11	9
17. Hang up my clothes	4	13	9
18. Improve my conduct toward other people	12	4	8
19. Not lose my temper	7	9	8
20. Help in the war effort	4	11	8
21. Do my homework promptly	11	5	8
22. Buy defense stamps	8	7	8
23. Have good manners - be polite	8	5	7
24. Cooperate with my friends	8	4	6
25. Help my parents	7	5	6
26. Keep my room in order	4	8	6
27. Brush my teeth twice a day	2	10	6
28. Improve my posture	3	9	6
29. Run errands for my mother	7	4	6
30. Not chew gum in school	4	7	6
31. Try not to get into fights	5	4	5
32. Respect other people and help them	3	5	4

TABLE VIII

SPECIFIC ITEMS MENTIONED BY THE CHILDREN PERTAINING TO THE HOME

A. Parents and Conduct
1. Obey my parents the first time
2. Not nag, annoy, sass, contradict, or argue with my parents, and respect them
3. Obey my mother promptly
4. Be good and improve in conduct and manners at home
5. Help my relatives
6. Not throw things around
7. Come home promptly
8. Appreciate my parents
9. Visit my grandparents
10. Not listen in on parents' conversation
11. Help members of the family
12. Tell mother everything
13. Try to understand my family

B. Helping Parents
1. Help around the house
2. Help my mother
3. Help my parents
4. Help with dishes more often
5. Run errands for mother
6. Help my grandmother
7. Help my father with yard work
8. Mow the lawn
9. Learn how to cook and bake
10. Help the family willingly
11. Take out the garbage

C. Home Routines and Habits
1. Go to bed early
2. Get up on time
3. Hang up my clothes
4. Do my homework promptly
5. Keep my room in order
6. Make my bed every day
7. Do necessary things
8. Keep my closet in order
9. Take care of my good clothes and change to play clothes
10. Not stay out late
11. Clean up any dirt or mess that I make
12. Take care of all my things
13. Polish my shoes every night
14. Be prompt - start doing something quicker than greased lightning
15. Come home from school promptly
16. Clean my room once a week
17. Keep my dresser drawers in order
18. Not listen to radio while doing homework
19. Not listen to radio when I go to bed
20. Not do homework in living room
21. Get things ready the night before
22. Be more neat

D. Sibling Relationships
1. Not fight with my brother
2. Not fight with my sister
3. Obey my sister

TABLE VIII (Continued)

4. Not argue with my brother
5. Help my brother
6. Watch my baby brother
7. Not disturb my brother
8. Help my sister
9. Be friends with brothers and sisters
10. Not argue with my sister
11. Not tease my sister
12. Not tease my brother
13. Not fight with my cousin
14. Not spoil my little brother
15. Not be jealous of my brother or sister
16. Obey my brother
17. Appreciate my sister

E. Food and Eating
1. Eat less - stick to my diet
2. Eat less candy
3. Eat all food served on table
4. Eat a better breakfast
5. Have better table manners
6. Not waste food
7. Eat better or eat more food
8. Not be a fussy eater
9. Drink four glasses of milk every day
10. Drink a lot of milk
11. Learn to like new foods
12. Eat slowly
13. Eat vegetables
14. Eat soup
15. Eat cooked cereal
16. Eat better lunches
17. Eat a lot of carrots
18. Eat peas
19. Go on a diet so I can look nice and have nice clothes and friends

F. Personal Health Habits
1. Stop biting my finger nails
2. Brush my teeth twice a day
3. Improve my posture
4. Brush my teeth every day
5. Brush my hair
6. Keep in good health
7. Follow health habits
8. Stop chewing gum
9. Keep up my health diary
10. Keep my finger nails clean
11. Stop putting pens and pencils in my mouth
12. Get washed every morning
13. Not go sled riding on busy streets
14. Stop picking my finger nails
15. Control my fingers
16. Wash my hands before meals
17. Take a bath more often
18. Wash behind my ears
19. Keep myself clean
20. Keep in shape
21. Wear my glasses regularly
22. Cross streets at corners and lights
23. Bring a clean handkerchief to school every day

TABLE VIII (Continued)

24. Not walk between parked cars
25. Stop picking my nose
26. Not lose the retainer which helps straighten my teeth
27. Not put my hands in my mouth
28. Stop sucking my thumb
29. Not forget to take my vitamins
30. Wash my face three times a day
31. Wash my hair more often
32. Comb my hair every day
33. Not scratch my head
34. Not use make-up
35. Be neat
36. Not ride too far on my bike
37. Not push my loose tooth back and forth
38. Stay indoors in bad weather
39. Not play with fire
40. Obey safety laws

dren overeat while others are fussy eaters.

To stop biting finger nails heads the resolutions under personal health habits. Next come, to brush teeth twice a day, to improve posture, brush and comb hair, keep in good health, follow good health habits, keep up with health diary, stop chewing gum, keep finger nails clean, and stop putting pens and pencils in the mouth. Keeping clean includes the resolutions to get washed every morning, wash hands before meals, wash behind the ears, take a bath more often, wash face three times a day, and wash hair more often.

Other personal health habits are, to wear glasses regularly, bring a clean handkerchief to school every day, not pick nose, not put hands in mouth, not suck thumb, and not scratch head. Safety rules include resolutions to cross streets at corners and lights, not walk between parked cars, not ride too far on bicycle, not play with fire, and obey all safety laws.

The data pertaining to home life, as expressed in the children's New Years resolutions, indicate their standards of ideal conduct toward which they are measuring themselves and toward which they feel they should work. Good relationship to family includes obeying and helping parents, getting along with siblings, participating in household responsibilities, and following personal routines and health habits. The data reflect the ideals and attitudes of home life in our culture in middle class homes, and the goals for growth the children set for themselves.

Areas Pertaining to the School—Table IX lists the areas pertaining to school life, arranged according to frequency. They stress the need to obey, respect, and help the teacher. They desire to improve their conduct in school, to be prompt in getting down to work, not to chew gum in school or put gum under the seats, not to cheat, to have good manners, and not to bother their neighbors. They resolve not to get out of their seats too often, not waste time, not run in the halls nor ask to be excused too often. They don't want to be absent but want to remember to bring a note when they are absent. They want to mind their own business but at the same time they want to be loyal to classmates and help them, to obey school laws, and not to get into trouble with the principal.

The children resolve to improve in their schoolwork by working hard and paying more attention to their studies. They aim to be more neat in their work and to try harder in handwriting, arithmetic, reading, spelling, pronunciation, vocabulary, and use of the dictionary. They want to have all their supplies, keep their desks in order, take care of their books, be thankful that they can enjoy school and not miss it.

The children's resolutions show good attitudes toward the teacher and school life. They try to progress in their studies and to get along with their teachers and classmates. The data show that school has a vital place in the lives of these children and is of great concern to them.

Areas Pertaining to Social Relations, Character and Personality Traits, and Patriotism—Table X gives the specific items mentioned by the children pertaining to social relations, character and personality traits, and patriotism, arranged according to frequency. Under social relations are listed, to be nice, kind, helpful, and

TABLE IX

SPECIFIC ITEMS MENTIONED BY THE CHILDREN PERTAINING TO SCHOOL

A. Relationship to Teacher
1. Obey my teacher
2. Cooperate, respect, be loyal to, be kind to, and help my teacher
3. Improve in a certain teacher's room

B. Conduct in School
1. Improve in conduct, have more self control, talk less, be more quiet
2. Be prompt and get down to work
3. Not chew gum in school
4. Have good manners
5. Not bother my neighbors
6. Not get out of my seat so much
7. Not waste time
8. Not run in halls
9. Not cheat
10. Not ask to be excused so much
11. Not be absent so much
12. Bring a note when absent
13. Help people who want to borrow something
14. Mind my own business
15. Be loyal to my classmates
16. Obey school laws
17. Not get in trouble with the principal
18. Not put gum under my desk

C. Schoolwork
1. Pay more attention, work hard, and improve in schoolwork
2. Do my homework and have it on time
3. Try harder in handwriting
4. Be neat in my work
5. Try harder in arithmetic
6. Improve in reading
7. Improve in spelling
8. Not miss school
9. Have all my supplies
10. Be thankful that I can go to school
11. Pronounce my words clearly
12. Make a better scrap book
13. Keep my desk in order
14. Use my dictionary more often
15. Improve my vocabulary
16. Learn to enjoy uninteresting subjects
17. Take care of my books
18. Try to like school

TABLE X

SPECIFIC ITEMS MENTIONED BY THE CHILDREN PERTAINING TO SOCIAL RELATIONS, CHARACTER AND PERSONALITY TRAITS, AND PATRIOTISM

A. Social Relations
1. Be nice, kind, helpful, and friendly to everyone
2. Have good manners - be polite
3. Cooperate with my friends
4. Try not to get into fights
5. Respect older people and help them
6. Be a good sport
7. Play fair
8. Don't criticise anyone or make fun of them
9. Try not to get into arguments
10. Don't talk when someone else is talking
11. Don't talk about people behind their back
12. Don't snub anyone or be stuck up
13. Learn more about sports
14. Don't be angry at girl friend
15. Cooperate in games
16. Not hit smaller children
17. Like people from all countries and races
18. Like my neighbors better
19. Make more friends
20. Be nice to girls (by boys)
21. Stop going around with a certain girl (by girls)
22. Respect other people's property
23. Play games other children like to play
24. Make up after a fight
25. Give compliments
26. Not snoop on other people
27. Wait my turn
28. Not pay so much attention to boys (by girls)
29. Try not to mind being with girls (by boys)
30. Get out more
31. Obey traffic rules
32. Try not to get excited
33. Answer my girl friend's letters
34. Not go around with bad boys (by boys)
35. Not play with children much younger than myself
36. Not spit down from the balcony in the show
37. Run errands for people
38. Attend scout meetings
39. Don't throw snowballs
40. Mind my own business

B. Character and Personality Traits
1. To improve my conduct toward other people
2. Not to lose my temper
3. Tell the truth at all times
4. Obey scout laws
5. Not complain, be cranky, or fussy
6. Not cuss or say bad words
7. Share things and not be selfish or greedy
8. Start the new year right
9. Live a better life
10. Try hard in every task
11. Not steal anything

TABLE X (Continued)

12. Not waste anything
13. Not put off doing things
14. Not argue so much
15. Don't cheat
16. Be thankful - appreciate what I have
17. Not stamp my feet
18. Carry my responsibilities
19. Not pout when angry at family
20. Work more - play less
21. Scold myself when I do wrong
22. Finish what I start
23. Have more patience
24. Depend upon myself more
25. Try to be interested in more things
26. Pay full fare on street car
27. Not be disgusted with myself
28. Have more self respect
29. Not blame things on other people
30. Not play mean tricks
31. Not go with people who steal
32. Not be silly
33. Not to cry
34. Take my punishment if I am wrong
35. Not stare at disabled persons
36. Not be careless
37. Not lose anything
38. Not wiggle when I get my shot at the doctor's office
39. Not have so many pleasures
40. Not be petty or hateful
41. Not talk so loud

C. Patriotism

1. Be a loyal citizen and help my country, especially during war
2. Buy defense stamps to help my country
3. Collect scrap, paper, and fat for war effort
4. Pray that war should be over
5. Obey laws

friendly to everyone; to have good manners and be polite; to cooperate with friends, to try not to get into fights or arguments, be a good sport and play fair, not criticise people, not talk behind their back or snub them. The children also made resolutions to like neighbors better, run errands for people, like people from all countries and races, make more friends, be nice to girls (boys say), not pay so much attention to boys (girls say), play games other children like to play, not hit smaller children, make up after a fight, not play with children much younger than myself, not go around with bad boys or people who steal, obey traffic rules, don't throw snowballs, and mind my own business.

Resolutions concerning character and personality traits were to improve in conduct toward other people, not to lose my temper, not stamp my feet, not pout, not complain, be cranky or fussy, not cuss or say bad words, not argue so much, cheat, steal, or waste anything, but try to live a better life, obey Scout laws, tell the truth, be thankful for what I have, work more, play less, have more patience, finish what I start, not put off doing things, depend upon myself more, have more self-respect, not blame things on other people, not be disgusted with myself, and not play mean tricks.

The children also resolved not to be silly, cry, or be careless, to take punishment when wrong, not to lose anything, not stare at disabled persons, not wiggle when getting a shot from the doctor, not talk so loud, not be petty or hateful, and not have so many pleasures.

The children who made resolutions during

1945 and 1946 stress patriotism more than the children studied later. They made resolutions to be a loyal citizen and help the country, to buy defense stamps, collect scrap, paper, and fat for the war effort, to pray that the war should be over, and to obey laws.

The data indicate that in the areas of social relations, character and personality traits, and patriotism, the children made many resolutions. These included the desire to have good social attitudes toward other children and adults, to improve in character and personality, and to be loyal and helpful to the United States.

D. Summary and Conclusions

Trends in children's New Year's resolutions, from 1945 through 1948, were studied for the purpose of gaining some understanding of children's daily problems of living and learning in our culture, as revealed in their New Year's resolutions. The 228 eleven- and twelve-year-old children were from suburban middle class homes in Cincinnati, Ohio.

The boys and girls were asked to list their New Year's resolutions on the day after New Years. The data were tabulated and arranged under resolutions pertaining to school, home, parents, conduct, home routines and habits, social relations, health habits, character and personality traits, siblings, food and eating, and patriotism.

The children averaged about eight resolutions per child, the girls averaging more resolutions than the boys.

The data show that school plays a vital role in the lives of these children. This is followed by home, parents, and home routines. Sixty-eight percent of all the resolutions covered 32 items. The ten items given most often, in order of frequency, were:

1. To improve in conduct in school
2. To improve in schoolwork
3. Have homework on time
4. Not fight with sibling
5. Obey parents the first time
6. Go to bed early
7. Obey teachers
8. Cooperate, help, and respect teachers
9. Not nag, annoy, or contradict parents
10. Stop biting my finger nails

This report should be helpful to parents and teachers in enabling them to understand the children's problems and to form a basis of what to expect from children of this age and background. By making them more aware of the children's specific problems, parents and teachers can evaluate their standards, see if they fit in with their children's needs and abilities, and help them direct their efforts to achieve goals they feel are valuable towards the children's growth in emotional and social maturity.

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JOURNAL OF EXPERIMENTAL EDUCATION
(Volume 26, December 1957)

THE PROBLEM OF PRESSURE IN HANDWRITING

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The Problem of Pressure in Handwriting

PRESSURE IN the act of handwriting is a readily observable phenomenon. One may note the pressure of the fingers upon the barrel of the pen, the pressure of the pen upon the writing surface and the attendant pressure of the hand resting upon the writing surface. The attention of investigators has been focused primarily upon barrel pressure and point pressure. The early direct means of studying handwriting pressure, such as measuring the comparative widths of the strokes of the pen or the number of carbon impressions produced by the writers, were soon replaced by instruments which recorded point pressure graphically. Consequently, the major approach to the study of handwriting pressure during the first half of the current century has consisted of the recording and interpreting of graphic pressure curves designed to indicate the amount of force applied by a person in the act of writing.

Studies of the handwriting pressure curve have been strongly oriented toward psychological and physiological interpretations. Drever (1) for example, described three types of point pressure curves—masculine, feminine and clerical—and likewise noted the rhythmic character of the curve for grip pressure in his subjects. Wirtz (9) later made an elaborate psychological and physiological analysis of detailed characteristics of the point pressure curve. Pascal (4), who gathered data for average pressure, range of pressure, and speed from the point pressure curves of his subjects, did so primarily for the purpose of relating these factors as a cluster to other measures of personality. Similarly, Roman (6) studied point pressure and speed in over 2000 normal and abnormal subjects of ages 11 to 18 in relation to their age, sex and personality. Ruesch and Finesinger (5), on the other hand, examined handwriting pressure curves in order to gain insight into the muscular tension of psychiatric patients. These studies, which are representative of the nature of much of the research in pressure in handwriting, suggest that investigators have been particularly concerned with broader psychological and physiological problems and have thus turned to the study of the handwriting pressure curve in order to investigate these problems. There does not appear to be a similar concern in previous investigations for a precise study of handwriting pressure in relation to such educationally important factors as the legibility of handwriting or various rates of writing.

Investigations of handwriting pressure, furthermore, vary so greatly in their techniques of gathering and analyzing data that comparisons of the results of such studies are difficult. The studies mentioned in the preceding paragraph illustrate this point well. Drever (1) used a descriptive approach to his analysis of learning curves. He apparently developed his concept of the three "types" of writers from observations of gross pressure changes in an entire writing sample, the incidence of high pressure points in words and the relationship of writing speed to pressure. Wirtz (9), on the other hand, attempted to make a detailed physiological and psychological analysis of handwriting strokes by correlating photographic records of pen strokes with the point pressure curve. He infers, for example, from certain aspects of the pressure record such attributes as "a feeling of insecurity," "detachment," "relaxation" and "a feeling of relief." Other investigators, such as Pascal (4) and Roman (6), quantify such handwriting pressure data as average pressure, range of pressure and speed, and treat their results statistically. Since each of the above investigators also used different types of instruments for recording pressure and different types and lengths of tasks in producing the pressure record, the exact interpretation of their findings in relation to this study is problematical.

*This report is one of a series of studies by the Committee for Research in Handwriting, University of Wisconsin, for which financial and technical support was given by the Parker Pen Company, Janesville, Wisconsin. The original report was published as a research monograph of the School of Education, University of Wisconsin, February 1955.

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The Need for Additional Research on Handwriting Pressure

In the preceding discussion, marked differences were found in an examination of previous research on pressure in handwriting with respect to such factors as the types of pressure recorded, the types of recording instruments used, the nature and length of the writing sample used, the types of analysis of data used, the conditions under which the data were gathered and the basic purposes or intent of the research. There appears to be a definite need for a careful and intensive examination of handwriting pressure itself and of related phenomena which might further an understanding of the educational significance of the handwriting pressure curve.

More specifically, the present investigators felt that there is need for research on handwriting pressure which would involve:

1. The recording of handwriting pressure in a situation closely approximating the normal act of handwriting.
2. The use of the most accurate and highly refined type of recording instrumentation available.
3. The use of a standard sentence as the writing sample for comparative analyses of pressure patterns.
4. The refinement and application of quantitative techniques in the analysis of pressure data.
5. Careful control of the conditions under which the handwriting data are gathered.
6. The use of an educational frame of reference in the identification and selection of variables to be examined in relation to handwriting pressure.

The Scope of the Study

The current study was limited to an examination of point pressure since the inclusion of barrel and surface pressure recording would produce a more artificial handwriting situation. While it is likely that the personality characteristics and tension states of a writer are important factors in the pressure exerted in writing, the problems associated with the definition and measurement of such factors placed such considerations beyond the scope of the present study. Similarly, the subjective feelings and reactions of individuals to the handwriting task were not explored.

On the other hand, certain variables were identified by the investigators for inclusion in this study. For example, samples of handwriting represent varying degrees of legibility How might legibility of the writing sample be related to handwriting pressure patterns? Each handwriting pressure record has not only a force dimension but also a speed dimension. How might rate of writing be related to handwriting pressure patterns and likewise to the legibility of the handwriting sample? Might there likewise be a demonstrable relationship between handwriting pressure patterns and fine motor coordination of the hand? Since these variables of legibility rate of writing and fine manual coordination appeared to be related to handwriting, these were selected as variables for particular attention in this study. Adult subjects were used because of the presumed greater stability of their writing habits.

The Specific Purposes of the Study

To the extent that the specific purposes of a study serve to define its problems, the purposes enumerated below indicate the nature of the problems investigated. These purposes were:

1. To record point pressure in cursive handwriting as precisely as possible and to interpret the pressure records quantitatively.
2. To examine point pressure patterns in handwriting in relation to the legibility of the handwriting samples.
3. To examine the effects of various rates of writing upon point pressure patterns.
4. To examine the relationships between point pressure patterns in handwriting and a measure of fine motor coordination of the hand.
5. To examine the interrelationships among point pressure, legibility, rate of writing and motor control by individual and group techniques of analysis.

The General Approach of the Study

In order to carry out the specific purposes enumerated above, point pressure patterns in cursive handwriting for different writing rates were examined with the writing task held constant. The adult subjects of the study were initially selected to compare the handwriting samples of a group of writers thought to produce handwriting of high legibility with samples of a group believed to write with low legibility. The written samples produced in the experimental pressure-recording situation were judged for legibility. Supplementary motor control tests were likewise given. The point pressure records were then analyzed and interrelationships were determined among legibility, rate of writing, motor control and point pressure.

The Development of Instrumentation for Recording Handwriting Pressure

The preceding section has indicated the specific purposes of this study and the problems attacked. It is the purpose here to summarize briefly the types of instrumentation used in previous studies of handwriting and to describe in some detail the instrument designed to measure point pressure in the current study.

Instrumentation Used in Previous Studies of Handwriting Pressure

As noted earlier, studies of handwriting pressure have attempted to measure barrel and point pressure, either singly or in combination. Consequently, the instrumentation problem facing different investigators has varied according to the type of pressure record they wished to secure. This brief review of the instrumentation used to record handwriting pressure will be concerned with means of recording point pressure.

Ruesch and Finesinger (5) note in their review of handwriting pressure instrumentation that two relatively direct approaches have been used by some investigators to estimate roughly point pressure in handwriting. The first was by microscopic examination of the width of line, the assumption being that wide lines are produced with more pressure than thin lines. The second approach was to have the subject write upon a stack of thin sheets of paper separated by carbon paper so that the number of sheets upon which writing impressions were made could be examined as a means of determining the point pressure exerted. These crude estimates of point pressure were soon replaced by more refined measures.

The development of more exact instrumentation for the measurement of point pressure in handwriting took place along two major lines. One line of development was the use and refinement of a movable plate upon which the subject wrote. The vertical movement of the plate in the act of writing was measured mechanically. The second line of development was the construction of a stylus with an inner sleeve to which the writing point was attached. The movement of the inner sleeve in response to pressure on the point was likewise measured mechanically. The latter type of instrumentation was apparently described first by Drever (2) in 1913.

However, by far the more commonly used instrument for recording pressure both before that time and since has been the movable plate. In an unsigned 1915 article (1), the author notes that "continental investigators have employed a writing plate, whether connected directly with a lever for marking on a smoked surface, or resting on an air cushion pneumatically connected to a recording tambour." Later in 1934, Vernon (7) pointed out that a particular type of instrument for recording variations in surface pressure in handwriting, the Kraepelin balance, was used "in practically all pre-war German and American investigations." The various improvements made upon this instrument, such as those summarized by Ruesch and Finesinger (5) have not altered the basic mechanical processes involved. This is true, for example, of the specific improvements in design made by Wirtz (9) in 1938 and by Pascal (4) in 1943. Similarly, improvements in the design of styli used to record point pressure by Vernon (7) in 1934 and by Ruesch and Finesinger (5) in 1943 are basically mechanical in nature.

The conception of an instrument for securing and recording point pressure in handwriting in purely mechanical terms has several serious disadvantages, some of which Vernon (7) has pointed out. Some disadvantages of the use of mechanically supported writing surfaces.

1. Writing surfaces supported by springs or balances tend to yield unduly to pressure exerted upon them, thus creating an unnatural writing situation for the subject.
2. Such writing surfaces frequently show unequal amounts of displacement when equal pressure is applied to various portions of the surface.
3. Satisfactory calibration of mechanical pressure recording instruments is difficult if not impossible, except for a restricted pressure range.
4. The use of levers, tambours and the like for the mechanical transmission of pressure introduces such problems as friction and leakage which contribute to the inaccuracy of the pressure records.

Some disadvantages of the use of styli designed for the mechanical recording of point pressure are:

1. The yielding point may be an unnatural and disturbing influence to the writer. This effect, however, is probably less disturbing than mechanically supported writing surfaces which yield noticeably to pressure.
2. The connection of a tube to the stylus for transmitting air pressure to the recording needle introduces a highly artificial factor into the writing situation.
3. The last two disadvantages noted in the use of mechanically supported writing surfaces likewise apply to styli for recording point pressure.

A departure from purely mechanical means of securing and recording point pressure was

made in 1948 by Wenger (8). He designed an apparatus to measure pressure upon a movable plate in terms of four levels or zones of pressure. As a subject's writing pressure changed from one level of pressure to another, an electric switch and relay were activated to record cumulatively upon an electric timer the amount of time spent by a writer within certain pressure zones. The type of pressure record secured by Wenger, however, is not comparable to the detailed pressure changes obtainable upon more conventional pressure recording instruments.

It would appear that the four major disadvantages of the use of a mechanically supported writing surface could be overcome to a great extent by using electronic rather than mechanical means to record point pressure changes in handwriting. The instrument utilized in the current study involved electronic techniques and is described in the next section. A study reported by Luthe (3) in 1953 likewise used electronic techniques which differed primarily in technical details from that employed in the current study.

The Instrumentation of the Study

In designing the equipment for recording point pressure in handwriting in this study, an attempt was made to meet the following criteria:

1. A writing instrument of standard size, shape and weight, unencumbered by special attachments for recording purposes.
2. A firm, flat writing surface with an adjustable chair for maximum comfort.
3. A pressure-recording surface which would yield only minutely to point pressure, which would accurately record a wide range of pressure and which could be adjusted to meet the normal and comfortable writing position of the subject.
4. Highly sensitive, calibrated instruments to record point pressure.

The first criterion was met by selecting a Parker 51 pen with a medium point which was used by all subjects for all writing tasks.

The second criterion was met by designing a special desk of standard height which provided support for the entire forearm in writing, as illustrated in Figure 1. An adjustable chair was fitted to the subject's sitting height.

To meet the third criterion, a metal plate or platen was used as the pressure recording surface. The platen was mounted in a movable disk in the center of the desk so that both the platen and the disk were flush with the surface of the desk, as shown in Figure 2. By rotating the disk, the platen could be placed at a comfortable writing angle for the subject. The platen rested upon four strain gauges designed to measure minute changes in the amount of force exerted upon the surface of the platen.[1*]

The fourth criterion was met in part by the design and selection of the platen and strain gauges and in part by the use of a vacuum tube amplifier and a recording oscillograph. The voltage changes developed by the strain gauges were amplified by the vacuum tube amplifier. The voltage changes thus amplified were transmitted to the oscillograph, activating a small metallic mirror from which a beam of light was reflected onto sensitized photographic paper moving at the rate of one inch per second. The oscillograph records were thus photographic records of the amount of force exerted at any time upon the metal platen. The instruments were carefully calibrated to produce a displacement of the mirror that would be linearly proportional to the force exerted on the platen. The sensitivity of the recording instruments was calibrated every hour by placing a standard 100 gram weight on the platen and recording the reference point thus established on the oscillographic record. Lines marking intervals of one-tenth of a second were also recorded photographically.

An oscillographic record of one subject is shown in Figure 3. This illustrates the source from which most of the data for this study were gathered. The writing situation and recording instruments used to secure this record are shown in Figure 4. In the experimental situation the recording instruments were removed some distance from the writing desk to avoid distracting the subject.

Exploratory Studies of the Problem

The First Pressure Study

An initial study was made of 12 pupils in grades 4, 5 and 6. This study served a twofold purpose by (1) offering an opportunity to examine techniques for analyzing the pressure records, and (2) establishing in part the basis for selecting the writing tasks which have been employed in the present study.

Using the electronic pressure recording equipment previously described, the 12 pupils were directed to write their names, the alphabet and the sentence "The quick brown fox jumps over the lazy dog." This sentence includes all letters of the alphabet. In each case the pupil was asked to write this sentence four times: First, in his usual way of writing, no suggestions about writing speed or legibility being offered; second, more carefully and more slowly; third, faster than he usually wrote; and finally, at a still fast-

*All footnotes will be found at end of article

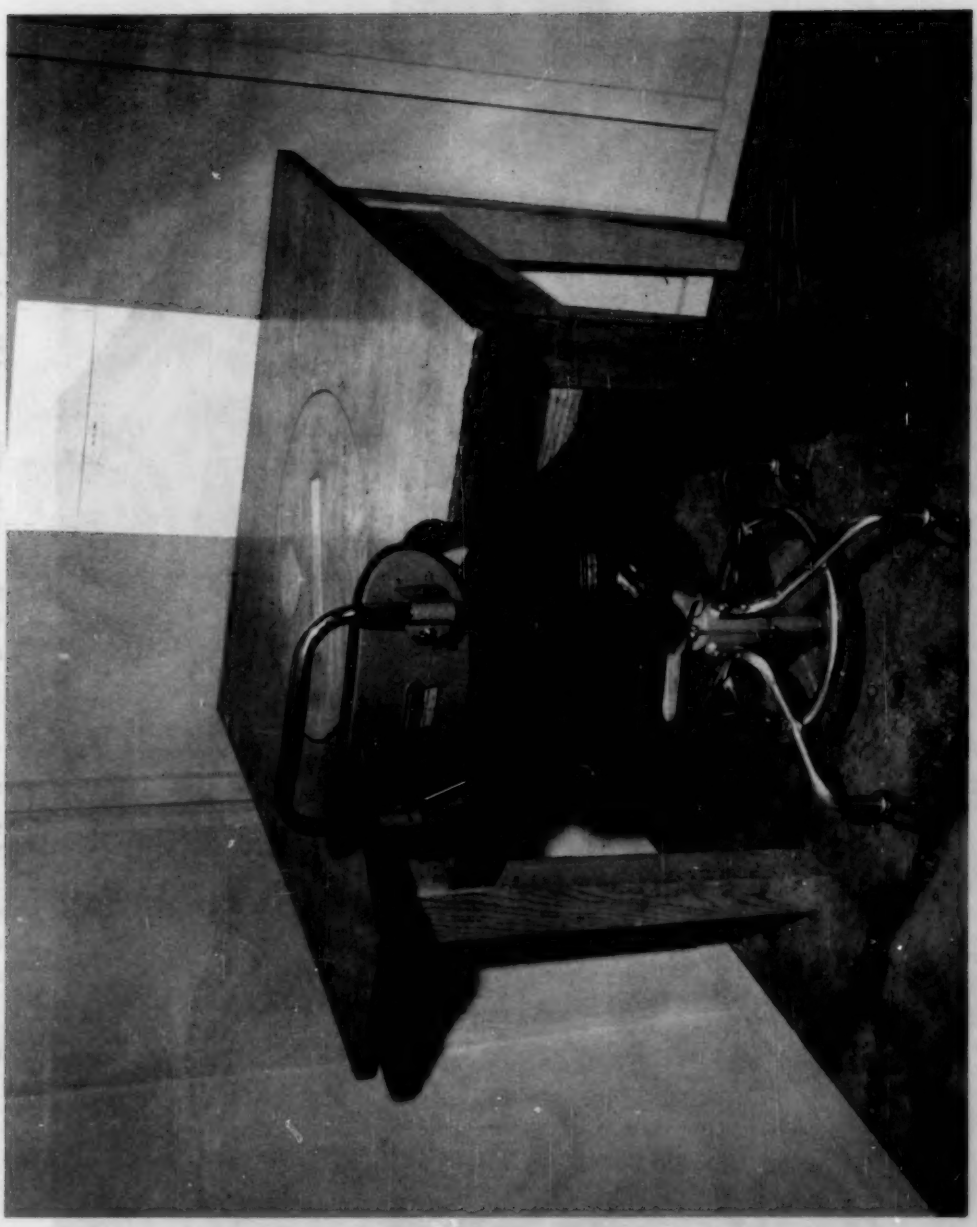

Figure 1. Desk Used in the Handwriting Study

Figure 2. Surface of the Handwriting Desk Showing the Platen and Movable Disk

Figure 3. An Oscillographic Record of a Subject's Fast Sample

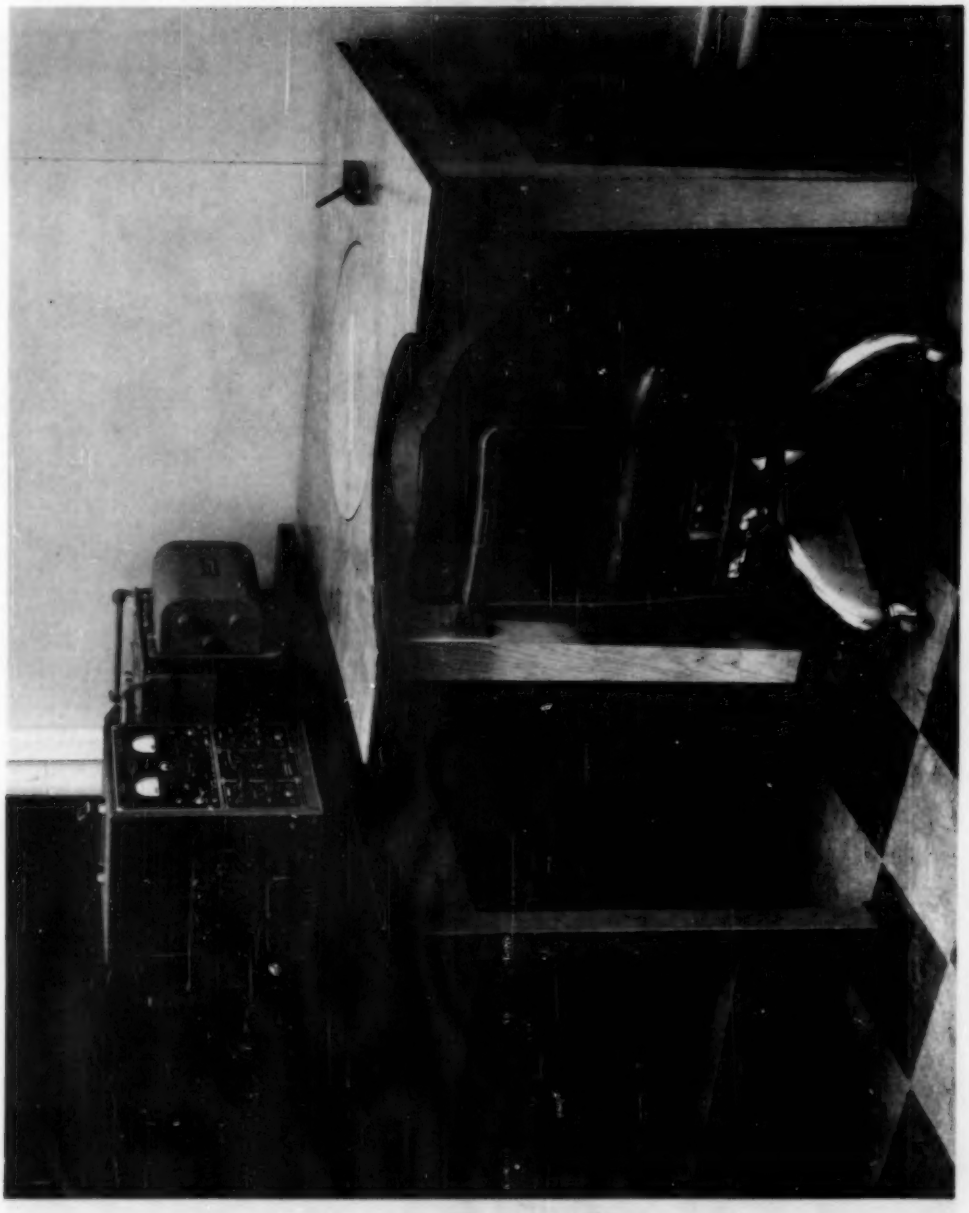

Figure 4. Desk and Recording Instruments Used in the Handwriting Study

er rate.

From the data secured, average word and sentence force in grams were computed. This made possible a comparison of average word and average sentence force patterns for each individual at four writing speeds. A comparison of average word and average sentence force patterns was also made according to the speed groupings—usual, careful (slow), fast, and faster.

An analysis of the pressure records revealed the following:

1. For each subject, the samples of their usual, careful and faster writing showed marked time differences. The "fast" sample as distinguished from the "faster" did not show time variations materially different from the "usual" sample.
2. The force patterns for the twenty-six letters of the alphabet when written in isolation, proved by inspection to be distinctly different from the force patterns for the same letters when written in the context of the standard sentence.
3. An analysis of average word force showed no consistent force pattern for identical words produced either by the same person at four different speeds or by different persons at each of the four different writing speeds.
4. An analysis of average sentence force, as contrasted to average word force, revealed a general force pattern. Average sentence force tended to increase as the subject moved away from his "usual" writing either to "faster" or to "careful" writing.

These results suggested that different rates of writing could be produced for experimental purposes since different times were consistently produced by the writers. Average sentence force appeared to be a more stable and useful index of pressure than average word force, the latter not showing consistency within or between subjects at the four speeds.

The Second Pressure Study

The second pressure study entailed a comparison of the point-pressure patterns of two college subjects, one of whom consistently produced high-quality handwriting, while the other produced handwriting uniformly low in quality. Identical writing tasks were used for both subjects in each of three writing tests. Each handwriting test included the subject's name and a standard sample of the subject's usual writing, slow writing, fast writing and a second sample of usual writing.[2] The standard sentence used was "The quick brown fox jumps over the lazy dog." Each subject took two complete tests on one day and a third test a week later. A total of 12 pressure recordings of the standard sample was thus available for analysis. In addition, a series of motor control tests was designed to measure (1) steadiness, (2) accuracy, and (3) speed and accuracy of hand and finger movements similar to those involved in the handwriting act.

Analyses of the pressure records in the second study indicated that:

1. Both subjects were able to vary their speeds satisfactorily in writing the standard sentence.
2. At each testing period both subjects produced slow, normal and fast samples that were clearly differentiated in writing speed.
3. In every sample the high-quality writer showed greater steadiness of pressure as measured by average word force than did the low-quality writer.
4. There was no evidence that either subject produced a consistent word or sentence force pattern for all samples. For both subjects, however, average word and sentence force tended to increase when they wrote faster than their usual writing rate.

The motor control tests disclosed that the high-quality writer was the more accurate in all accuracy tests, whereas the low-quality writer moved with greater speed but produced more errors. The test for steadiness of hand movement showed no consistent results.

Results of Exploratory Studies

The two preliminary investigations were helpful in shaping the general design of the present study, in selecting the writing tasks and in developing methods of analyzing the pressure records. Both preliminary studies indicated that the standard sentence was an adequate writing test in terms of length, content and ease of administration. It was evident that reasonable confidence could be placed in the subject's ability to produce real time differences when directed to write at three designated speeds—slow, normal and fast. The preliminary results suggested that further study of the effect of changes in speed of writing upon pressure should be made.

Analysis of the pressure records of both children and adults suggested that new ways of analysing the point pressure records should be sought. The preliminary studies also indicated the desirability of continuing the use of measures of motor control, although it appeared that further refinement and simplification of the motor control tests would be necessary. Since the pressure records and the writing behavior appeared to be more stable in adult subjects than

in the children, adults were selected for the present study.

Procedures Used in Collecting and Analyzing the Data

Selection of the Subjects

The subjects for the present study were selected on the basis of the legibility of handwriting produced in a written examination. The final examination papers of 230 college undergraduate students in educational psychology at the University of Wisconsin were secured. The investigators independently identified the 20 "easiest-to-read" papers and the 16 "most-difficult-to-read" papers.

These 36 papers were then placed in random order and submitted to the six other members of the handwriting committee. The committee members likewise independently sorted the randomized papers into "easy-to-read" and "difficult-to-read" groups. All judges agreed in identifying the 16 difficult-to-read papers. Four of the 20 easy-to-read papers were thought to be in an intermediate category by three of the six judges and were therefore eliminated. Thus 16 easy-to-read and 16 difficult-to-read papers remained.

Of the 32 subjects thus selected, only ten of those who produced easy-to-read papers and ten who produced difficult-to-read papers were able to participate in the project. One subject in the latter group was born and educated in Germany. Since the influence of German script writing with its attendant pressure phenomena made the interpretation of the subject's samples questionable, this subject was eliminated. The population of the study thus consisted of 19 subjects, nine men and ten women. Two men and seven women were in the easy-to-read group, and seven men and three women were in the difficult-to-read group. All subjects were right-handed.

Testing Procedure

All subjects were tested individually in a room which was specially furnished and equipped for the handwriting pressure experiment. Prior to taking the tests, each subject was given a few minutes to relax. The subject was then seated at the writing table, and the function of the equipment and the tasks to be performed were explained to him. He was asked to write his name to help accustom him to the testing situation.

The subject was told that he would be expected to write two samples of the standard sentence at his usual rate of writing, one sample at a slow rate of writing and one sample at a fast rate of writing, each on a separate card. He was informed that his samples were to be timed. He was questioned to find out under what circumstances he wrote at his usual rate, at a slow rate and a rapid rate. The subject was then asked to try to duplicate these rates of writing in the test situation. For example, since most subjects said they wrote most rapidly when taking notes in lectures, they were asked to write their fast sample as if they were taking notes.

Four writing samples and four pressure records were obtained for each subject. Since preliminary analysis showed the two "usual" samples and pressure records to be substantially the same, the second usual sample was arbitrarily selected for further analysis. In addition, a series of motor control tests to be described later were administered.

Techniques of Analyzing the Variables

The raw data consisted of three types of data for each subject: (1) three handwriting samples of the standard sentence, (2) three pressure records of the standard sentence, and (3) the results of the motor control tests. The legibility of the handwriting samples was used as a basic referent for analyzing the pressure and motor control data. Writing time was also used as a referent for analyzing the pressure records in that three separate rates of writing (S N F) were included. Actual writing time for each sample was secured directly from the pressure record. Thus legibility and rate of writing were used as bases for examining changes in point pressure, actual writing time and motor control. How the basic data for each of the variables were measured will now be described.

Legibility—It will be remembered that the subjects of the study were originally identified by the legibility of their handwriting on course examination papers. Inspection of the legibility of the three handwriting samples produced by each subject in the laboratory test situation, however, showed that the legibility of the samples of the individual varied in many cases. For example, some samples produced by "poor" writers appeared to be as legible as some produced by "good" writers. A decision was therefore made to group the samples produced in the test situation according to the legibility of the sample, irrespective of the individual producing the samples.

Accordingly, the 57 samples were separated into three groups: easy-to-read, difficult-to-read, and a middle group. The lower limit of the easy-to-read group and the upper limit of the difficult-to-read group of the sample examination papers were used as reference points for classifying the samples into these three groups. An easy-to-read and a difficult-to-read sample are shown in Figure 5.

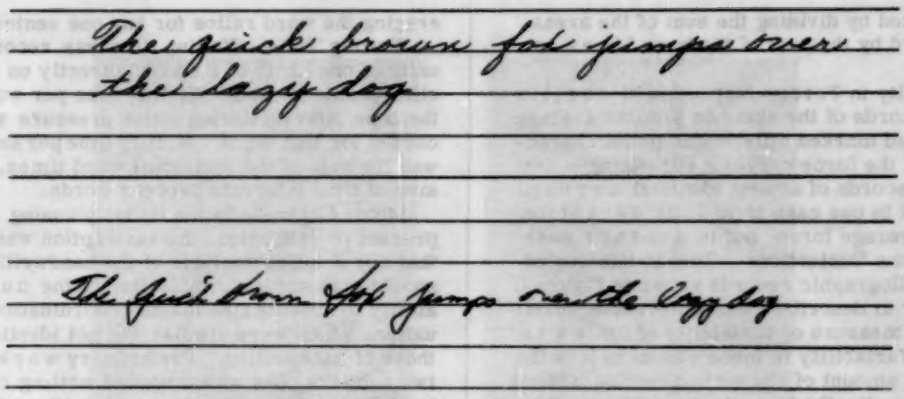

Figure 5. Easy-to-Read and Difficult-to-Read Handwriting Samples Used in the Study

Members of the legibility group of the handwriting committee were then asked to group the samples independently in the above manner and also to place the 57 samples in rank order according to legibility. There was 97 percent agreement among the three judges in grouping the samples into the three legibility categories. When the samples were independently ranked according to legibility by the judges, the rank order correlations ranged from .81 to .95. Since each member of the legibility group arrived at his judgment independently, the close agreement among the judges indicated that a reasonably high degree of confidence may be placed in the grouping and ranking thus secured.

Average Word and Sentence Force—Force was measured by utilizing a Kueffel and Esser compensating polar planimeter. This type of planimeter records cumulatively the distance traversed regardless of direction. The planimeter was adjusted so that the measuring point rested on the starting point indicated by the arrow in Figure 6. The total area enclosed by the word force lines and the base line was measured by the planimeter in a clock-wise direction. When the planimeter again rested upon the starting point, the total area was read from the planimeter. The figure thus obtained was divided by the length of the base line for that word to derive the average word force. Average sentence force

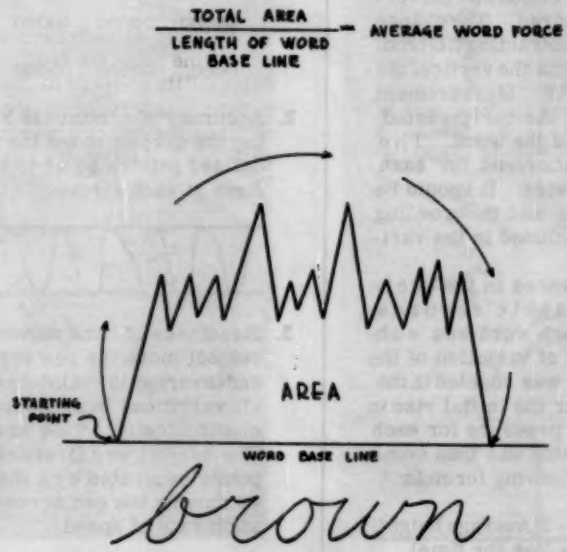

Figure 6. Procedure for Measuring and Computing Average Word Force

was computed by dividing the sum of the areas of each word by the sum of the base lines for each word.

Variability in Force—Inspection of oscillographic records of the same or similar average force showed marked differences in the characteristics of the force curves. For example, two pressure records of almost identical average force might in one case show little deviation from the average force, but in another case show extreme fluctuations. This is illustrated by the oscillographic records shown in Figure 7.

In order to describe these differences quantitatively, a measure of variability of force was devised. Variability in force was taken to be the cumulative amount of change in direction of force measured vertically from the base line. The number of measurements taken on a given record depended upon the number of times the direction of the force curve changed to the extent of one millimeter measured in a direction parallel to the base line. Slight changes in direction of pressure less than one millimeter were not thought to be significant. Variability in force thus measured represents an attempt to describe differences in the total amounts of deviation from the base line for the word or sentence.

The specific method of determining variation in force is illustrated in Figure 8. A metric ruler was moved from left to right at right angles to the base line until the point at which the pressure curve first changed direction was reached. The vertical distance from this point A to the base line was noted. The ruler was then moved to the next point C on the pressure curve denoting a change in direction and the vertical distance was again measured. The change in pressure was derived by subtracting CD from AB. This difference represents the vertical distance between the two points AE. Measurement continued in this manner until the curve rested upon the base line at the end of the word. The total amount of change thus measured for each word and sentence was calculated. It should be noted that the dotting of the i's and the crossing of the t's and x's were not included in the variability measure.

In order to equalize differences in the average pressure of the oscillographic records, twice the average height of each word was subtracted from the total amount of variation of the force curve. Average height was doubled in the computation to compensate for the initial rise in pressure and final release of pressure for each word. The force variation ratio was then computed for each word by the following formula:

$$FVR = \frac{\text{Change in millimeters} - 2(\text{Average height})}{\text{Length of word base line (or time)}}$$

Sentence variation ratios were computed by averaging the word ratios for any one sentence.

Writing Time—Writing time was recorded in units of one-tenth of a second directly on the oscillographic record. Writing time per word was the time interval during which pressure was recorded for that word. Writing time per sentence was the sum of the individual word times, exclusive of time intervals between words.

Motor Control—In the initial planning of the present investigation, the assumption was made that any detailed analysis of the handwriting act should give some consideration to the subject's ability to execute fine manual coordinations in situations which were similar but not identical to those of handwriting. Preliminary work with two subjects, one who produced writing of high legibility and one who produced writing of poor legibility, suggested that motor control as measured by tests of this type would differentiate between writers of high and low legibility. Motor control tests were therefore devised which involved the use of a writing instrument in tasks involving fine manual coordination.

The tests which were originally selected were designed to measure speed and accuracy of interrupted hand and finger movement, accuracy of continuous hand and finger movement and steadiness of hand movement. The types of tasks which were utilized were:

1. Measurement of speed and accuracy of interrupted hand and finger movement by having the subject place the pen point as rapidly as possible in a series of small circles arranged in groups of five.

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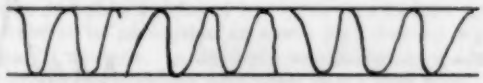
   oooooo oooooo oooooo oooooo oooooo

2. Accuracy of continuous hand movement by having the subject move the pen continuously in a defined pattern so as to touch the parallel lines at each stroke.



3. Steadiness of hand movement by having the subject move the pen across the paper while endeavoring to maintain constant pressure, all variations in pressure being recorded electronically. This was done in two ways. The subject was first asked to connect two points separated by a distance of four inches by moving the pen across the paper at a constant rate of speed.

   o——————————o

The subject was next asked to draw four short

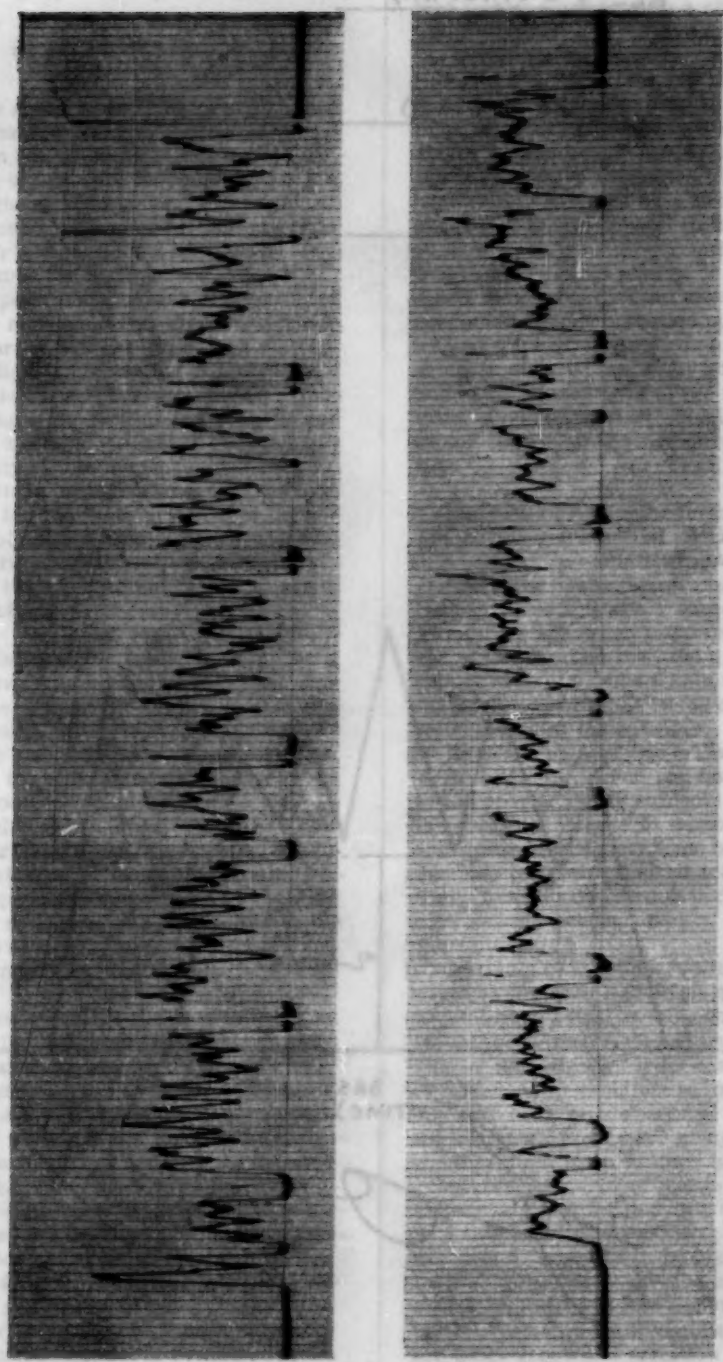


Figure 7. Comparison of Variability in Force Patterns for Two Oscillographic Records Having Similar Average Word Force

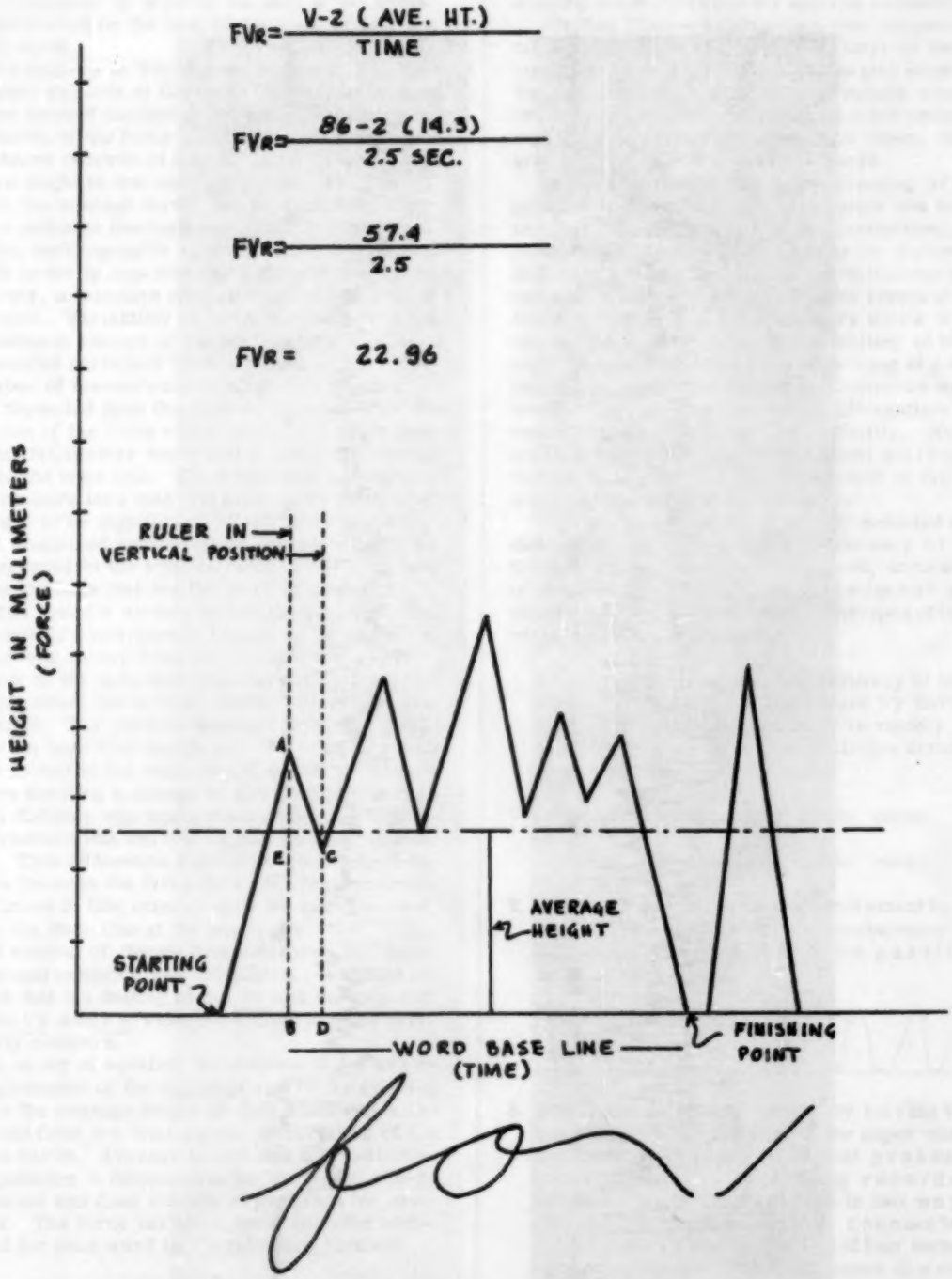
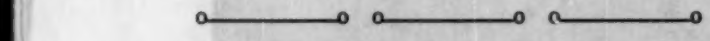


Figure 8. Method of Determining Variation in Force

horizontal lines across the page, each line connecting two points separated by a distance of one inch.



In both tests the speed of pen movement was paced by a mechanical guide. Specific directions were given to each subject to exert as constant an amount of pressure as possible on the pen point throughout these tasks. For each task, variation in force was computed by the method previously described, and a force variability ratio was derived for each person.

The test of speed and accuracy of interrupted hand and finger movement was discarded due to problems of scoring the test itself, and also because of the difficulty in arriving at a meaningful score for speed and accuracy for each subject. The measure for accuracy of continuous hand movement was also discarded because of the low reliability of this measure, namely .30.

From the battery of motor tests originally employed, only the two tests designed to measure steadiness of hand motion were retained. Several considerations entered into the final selection of these two tests as indicators of fine manual coordination:

1. The simplicity of the tests.
2. The relatively high reliability of the four line test, .88. The reliability was computed by correlating the sum of the variability ratios of the first and fourth lines with the sum of the variability ratios of the second and third lines.
3. The correlation of .86 between the force variation ratios of the two tests. This gives substantial evidence that similar factors are operating in the two tests, and that these measures are reasonably stable indicators of hand steadiness in this type of fine manual coordination.

Since the force variation ratios obtained for each subject on the two motor control tests were derived in the same manner as the force variation ratios taken from the oscillograph record for each of the handwriting samples, a comparable measure of variability of force was thus obtained for each subject in a non-writing task and in a writing task. When the force variation ratios of the short-line motor control tests are correlated with those for the standard sentence samples written at normal speeds, the correlation coefficient is .81. An indication that motor control, defined as steadiness of point pressure in the straight-line test, operates to a considerable degree in the handwriting act is evidenced by the magnitude of this correlation. Since the correlation coefficient of the force variation ratios of the standard samples at normal speeds was considerably lower, .49, the short-line motor control test was retained as a single index of fine motor control. Oscillographic records illustrating extremes in pressure variation on the short-line motor control test are shown in Figure 9.

It is reasonable to believe that a high degree of motor control of the hand is required for the steady application of force during handwriting. While subjective estimates of the legibility of handwriting samples may be indicative of certain aspects of motor control in the horizontal plane, variability in pressure is indicative of motor control in the vertical plane. It should be recognized, however, that the motor control test was conducted under controlled speed conditions, whereas the writing speeds for the handwriting samples differed markedly within and between subjects. Acceptance of the force variation ratio of each handwriting sample as a measure of motor control would therefore seem to be justified.

Techniques of Analyzing Interrelationships Among the Variables

The interrelationships among the factors of legibility, writing time, force and variation in force were examined in three ways: (1) rank order of the data for the total group of 57 samples, (2) patterns of change within the individual, and (3) patterns of change based on a threefold quality grouping of the samples.

Rank Order Analysis—Three writing samples written at slow, usual and fast rates respectively for each of the 19 subjects were included in the analysis. These 57 samples were ranked according to legibility from best to poorest. The samples were also ranked according to writing time, force and variation in force. Rank order correlations between each of these variables were computed.

Analysis of Individual Patterns—The three samples for each individual were first ranked according to actual writing time from slowest to fastest. Similarly, the same samples were ranked in legibility, from best to poorest, and in force and in variation in force from lowest to highest. The rank orders of the three samples for each individual were compared to determine whether changes in writing speed resulted in corresponding patterns of change in legibility, force and variation in force within the individual.

Analysis by Grouped Samples—The total group of 57 samples previously ranked according to legibility was divided into thirds, giving a high-legibility, a low-legibility and a medium-legibility group. In a like manner the rankings for time, force and variation in force were divided into thirds and then compared with the legibility groupings.

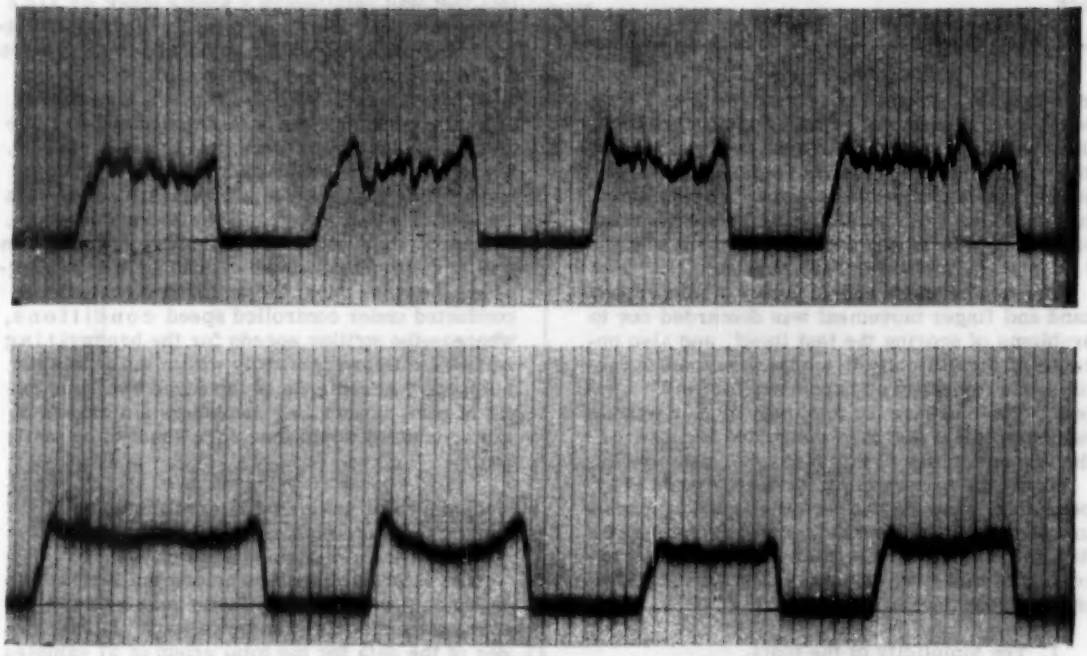


Figure 9. Oscillographic Records of Contrasting Variation in Force on the Short-Line Motor Control Test

Results of the Investigation

Legibility—Ten good writers and nine poor writers were originally identified by the legibility of their handwriting in a university course examination. Subjects 1, 3, 4, 6, 7, 9, 10, 12, 15, and 16 were judged to be good writers. Subjects 5, 8, 11, 13, 14, 17, 18, 19, and 20 were judged to be poor writers. When the slow, normal and fast samples were secured for each of the 19 subjects under the laboratory testing conditions and sorted into three legibility groupings described previously, the distribution of the 57 samples shown in Table I resulted. The distribution yielded 16 samples of high legibility, 14 samples of low legibility and 27 samples of medium legibility.

The large number of samples in the medium group represents a sizable shift from the original easy-to-read and difficult-to-read groupings. Of the ten original good writers, only subjects 6, 16 and 4 maintained writing of high legibility as their rate of writing varied from normal to slow to fast. Of the nine poor writers, only subjects 11 and 14 consistently produced samples of low legibility under similar conditions. Thus, only eight of the 19 writers maintained a uniform legibility of writing as speed was varied. None of the poor writers produced a highly legible sample, and only subject 1 of the original good grouping produced a sample which was judged low in legibility.

Table I likewise suggests that the legibility of the sample may be influenced by relative rates of writing. For example, in all cases the slow sample was judged to be as good as or better than the normal and fast samples. On the other hand, the fast samples of nine of the 19 subjects —3, 9, 15, 13, 1, 17, 20, 8, 19—were judged to be poorer than either their normal or slow samples. Two additional subjects, 7 and 18, pro-

TABLE I

LEGIBILITY OF SAMPLES AT THREE WRITING RATES

High N = 16			Medium N = 27			Low N = 14		
Slow	Normal	Fast	Slow	Normal	Fast	Slow	Normal	Fast
6	6	6						
16	16	16						
4	4	4						
3	3				3			
9	9				9			
15	15				15			
7			7	7				
			12	12	12			
			5	5	5			
			10	10	10			
			13	13				13
			1	1				1
			17	17				17
			20	20				20
			8	8				8
			19	19				19
			18				18	18
						11	11	11
						14	14	14

duced neither normal nor fast samples of as high legibility as their slow samples.

Actual Writing Time—Since each subject was allowed to regulate his own rate of writing at the time the writing samples for the pressure study were gathered, it was to be expected that the speed at which samples were written would vary greatly. For example, the slowest sample was written in 39.2 seconds, the fastest sample in 8.99 seconds. Figure 10 shows that differences in time between the slow and fast samples varied from 24.26 seconds for subject 7 to 3.54 seconds for subject 14. This indicates that each subject produced slow and fast samples that could be differentiated in writing time from the sample written at his usual rate. Figure 10 also shows, in comparing the average time for writing the slow and fast samples with the average time for the normal samples, that the proportional increase in rate of writing for fast samples was not as great as the decrease in rate of writing for slow samples. This is indicated by an average deviation of 5.4 seconds for fast samples from normal speed, as compared to 7.4 seconds average deviation for slow samples.

Figure 11 illustrates the average writing time for the slow, normal and fast samples. It will be noted that in no case is there an overlapping of average writing times for individual words. This suggests that differences in average writing times noted above for sentences hold equally well for individual words of the sentence. There is also evidence from this figure that the curve for words for the fast sample more nearly approximates that of the normal sample than does the curve for the slow sample.

Average Word and Sentence Force—The average word force for samples grouped according to slow, normal and fast speed categories is shown in Figure 12. While the average force curves are similar in form, they differ substantially in average word pressure exerted at each of the three speeds. It will be noted that in no case do the curves overlap. The figure also shows that the average word force of samples written at normal speed show the least pressure, those at slow speed show still greater pressure and those at fast speed show the greatest pressure. It is likewise clear by inspection that this is true for average sentence force. There appears also to be some tendency, illustrated most clearly by the slow group of samples, for the pressure to increase as the sentence is written. In each case, the average pressure for the last word of the sentence is greater than the average pressure for the first word of the sentence.

Differences in average word force for individuals varied from 45 grams for subject 13 to eight grams for subject 8. Average sentence force varied from 26 grams to 134 grams. A comparison of the force curves for average word force in Figure 12 with those for average writing time in Figure 11 shows that the respective curves do not overlap at any point. In other words, the differences in average word force for samples written at different speeds are as clearly evident as the previously described differences in samples grouped according to actual writing time.

Variation in Force—Variability in force, as indicated by the sentence force variation ratio computed and described in the section on "Procedures Used in Collecting and Analyzing the Data", ranged for all samples from 2.35 to 24.31. Differences in the sentence force variation ratios among the three samples for each individual ranged from 1.60 to 16.09. When the samples were grouped according to normal, slow and fast categories, as shown in Figure 13 (see page 173), it would appear that variation in word force is related to the relative speeds at which the individual's three samples were written.

It will be noted that there is no overlapping of the force variation curves. Variation in word pressure is consistently the least for the slow group of samples and consistently the greatest for the fast group of samples. The degree of variation in word pressure for the normal group of samples is not much greater than for the slow group of samples. The variation in word pressure for the fast group of samples is much greater than for either of these.

Results of the Rank Order Analysis

The 57 samples were placed in rank order for each of the variables of legibility, time, pressure and variation in force. Rank order correlations were obtained between each of these variables.[3] These correlations are shown in Table II.

TABLE II

RANK ORDER CORRELATIONS BETWEEN LEGIBILITY, TIME, PRESSURE AND VARIATION IN FORCE

Variables	Rho
Variation in force[a] and pressure[b]	.69
Variation in force and time[c]	.67
Variation in force and legibility[d]	.59
Legibility and time	.54
Pressure and time	.22
Pressure and legibility	.01

[a]Ranked from low to high
[b]Ranked from low to high
[c]Ranked from slowest to fastest
[d]Ranked from best to poorest

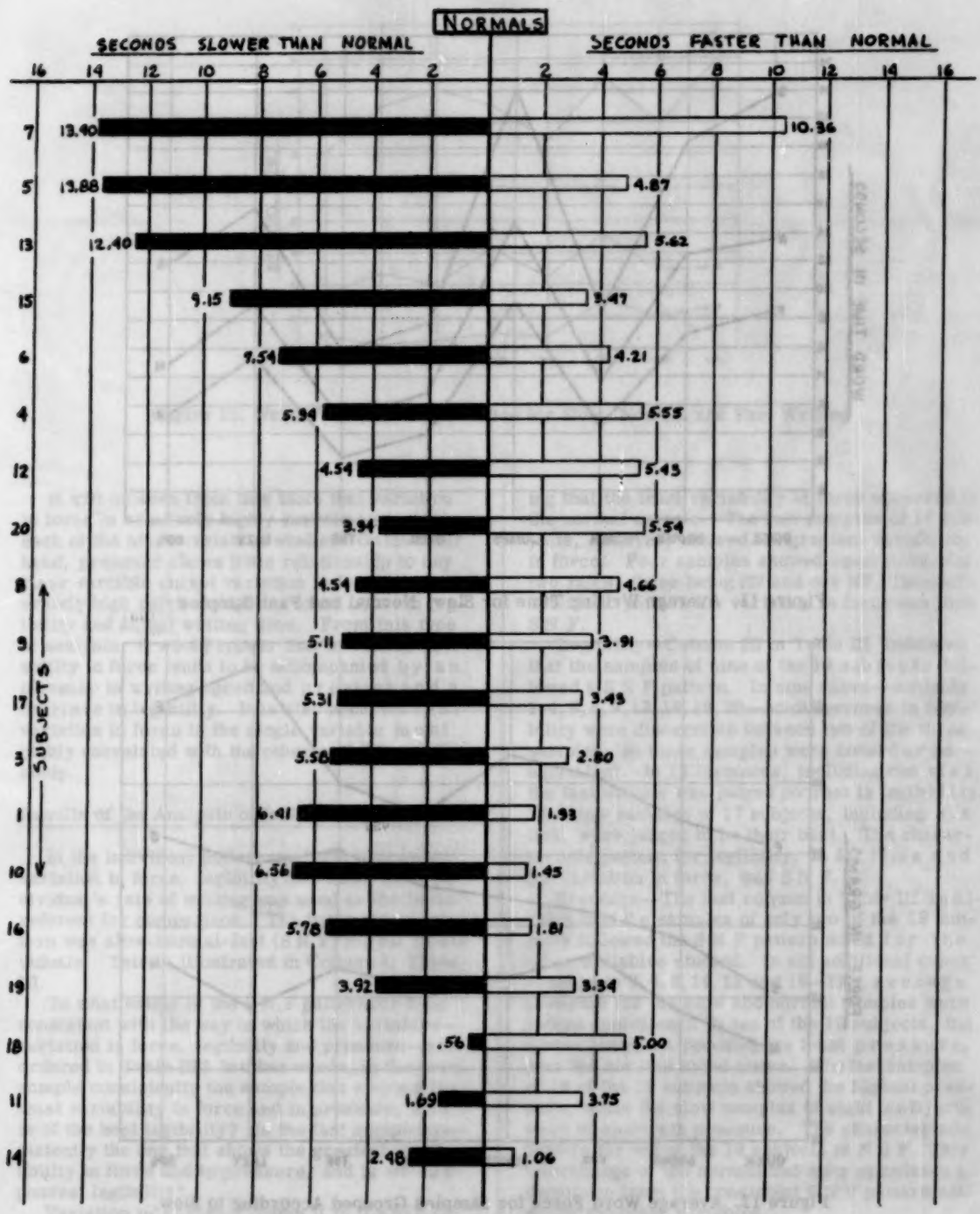


Figure 10. Individual Ranges and Deviations in Writing Time

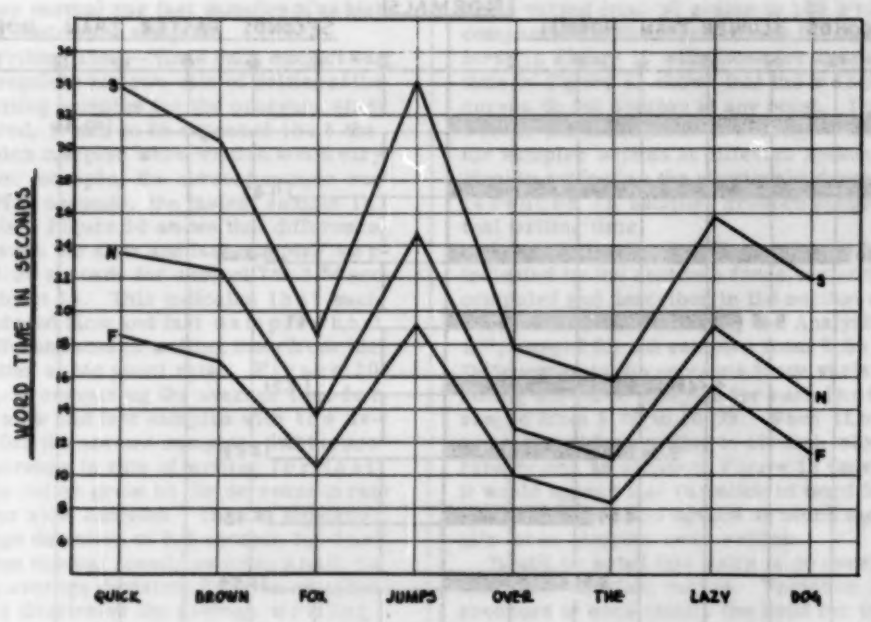


Figure 11. Average Writing Time for Slow, Normal and Fast Samples

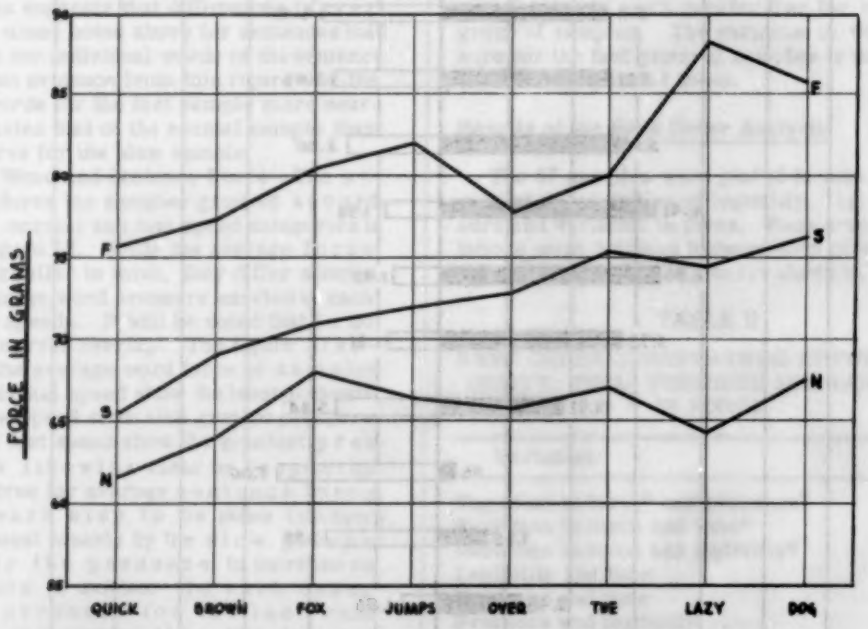


Figure 12. Average Word Force for Samples Grouped According to Slow, Normal and Fast Speed Categories

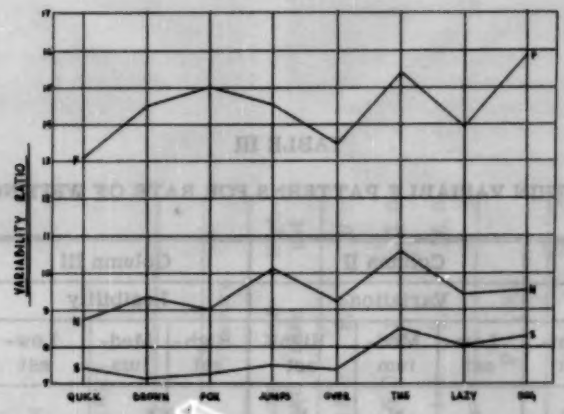


Figure 13. Word Force Variation Ratios for Slow, Normal and Fast Writing

It will be seen from this table that variation in force is relatively highly correlated with each of the other variables studied. On the other hand, pressure shows little relationship to any other variable except variation in force. A moderately high relationship was found between legibility and actual writing time. From this type of analysis, it would appear that increased variability in force tends to be accompanied by an increase in writing speed and pressure and a decrease in legibility. It is also apparent that variation in force is the single variable most highly correlated with the other variables of the study.

Results of the Analysis of Individual Patterns

In the individual pattern analysis of pressure, variation in force, legibility and time, each individual's rate of writing was used as the basic referent for comparison. The basic speed pattern was slow-normal-fast (S N F) for all individuals. This is illustrated in Column I, Table III.

To what extent is the S N F pattern for time consistent with the way in which the variables—variation in force, legibility and pressure—are ordered in Table III? In other words, is the slow sample consistently the sample that shows the least variability in force and in pressure, and is of the best legibility? Is the fast sample consistently the one that shows the greatest variability in force and in pressure, and is of the poorest legibility?

Variation in Force—Column II in Table III shows that the samples of 13 of the 19 subjects followed the basic S N F pattern. Two subjects —16 and 20—followed a N S F pattern, indicating that the least variability in force occurred in the normal sample. The fast samples of 18 subjects, however, showed the greatest variability in force. Four samples showed equal values for two rates, three being SN and one NF. The characteristic pattern for variation in force was thus S N F.

Legibility—Column III in Table III indicates that the samples of nine of the 19 subjects followed a S N F pattern. In nine cases—subjects 1, 4, 6, 8, 9, 12, 18, 19, 20—no differences in legibility were discernible between two of the three samples, so these samples were considered equivalent. In 18 instances, including two ties, the fast sample was judged poorest in legibility. The slow samples of 17 subjects, including six ties, were judged to be their best. The characteristic pattern for legibility, as for time and for variation in force, was S N F.

Pressure—The last column in Table III indicates that the samples of only two of the 19 subjects followed the S N F pattern noted for the other variables studied. In six additional cases —subjects 3, 4, 8, 14, 15 and 19—the average pressure for the slow and normal samples were judged equivalent. In ten of the 19 subjects, the normal samples revealed the least pressure, plus the six ties noted above. The fast samples of 16 of the 19 subjects showed the highest pressure, while the slow samples of eight subjects were of moderate pressure. The characteristic pattern for ten of the 19 subjects is N S F. This interchange of the normal and slow samples is a departure from the consistent S N F pattern noted for the other variables.

A chi-square table was set up for each of the variables in order to determine whether or not the obtained distributions differed significantly

TABLE III

WITHIN VARIABLE PATTERNS FOR RATE OF WRITING

	Column I			Column II			Column III			Column IV		
	Time			Variation			Legibility			Pressure		
Subject	Slowest	Medium	Fastest	Lowest	Medium	Highest	Highest	Medium	Lowest	Lowest	Medium	Highest
1	S	N	F	S	N	F	SN*		F	S	N	F
3	S	N	F	S	N	F	S	N	F	SN*		F
4	S	N	F	SN*		F	SN*		F	SN*		F
5	S	N	F	S	N	F	S	N	F	N	S	F
6	S	N	F	S	N	F	F	SN*		N	S	F
7	S	N	F	S	N	F	S	N	F	N	F	S
8	S	N	F	S	N	F	SN*		F	SN*		F
9	S	N	F	SN*		F	SN*		F	N	S	F
10	S	N	F	S	N	F	S	N	F	N	S	F
11	S	N	F	S	N	F	N	S	F	N	S	F
12	S	N	F	SN*		F	S	NF*		N	S	F
13	S	N	F	S	N	F	S	N	F	S	N	F
14	S	N	F	S	NF*		S	N	F	SN*		F
15	S	N	F	S	N	F	S	N	F	SN*		F
16	S	N	F	N	S	F	S	N	F	F	N	S
17	S	N	F	S	N	F	S	N	F	N	S	F
18	S	N	F	S	N	F	S	NF*		N	S	F
19	S	N	F	S	N	F	SN*		F	SN*		F
20	S	N	F	N	S	F	SN*		F	N	F	S

*Designates equal value for two samples.

TABLE IV

PROBABILITIES OF CHANCE DISTRIBUTION FOR INDIVIDUAL PATTERNS

	Variables											
	Time			Variation			Legibility			Pressure		
Rate	Slow-est	Med-ium	Fast-est	Low-est	Med-ium	High-est	Best	Med-ium	Poor-est	Low-est	Med-ium	High-est
N	0	19	0	3.5	1.5	.5	4	13.5	1.5	13.0	6.0	0
S	19	0	0	15.5	3.5	0	14	4.5	.5	5.0	11.0	3.0
F	0	0	19	0	.5	18.5	1	1.0	17.0	1.0	2.0	16.0
	P = .000			P = .001			P = .001			P = .001		

from a chance distribution. These frequency distributions and their probabilities are reported in Table IV. This test of significance indicates that the probabilities are great that the patterns of distribution obtained for the slow, normal and fast samples for each of these variables did not occur by chance.

Results of the Analysis of Grouped Samples

As a further check on the preceding types of analysis, all samples were grouped into thirds for each of the variables. This gave a group of 19 samples in the upper one-third, 19 samples in the middle one-third and 19 samples in the lower one-third for each of the variables studied. The basic referent for this type of analysis was the legibility of the sample. This type of grouping made it possible to determine how many of the upper, middle and lower one-third of the distribution contained samples of high, medium or low legibility with respect to each variable.

Legibility and Variation in Force—Table V shows the distribution of samples grouped into thirds according to legibility and variation in force. It will be noted that the frequency distribution reveals a tendency for high legibility samples to be written with little variability in force, and conversely, for low legibility samples to be most frequently written with high variability in force. Thus, ten of the 19 high legibility samples showed low variation in force, whereas only two of this group showed high variability. On the other hand, 13 of the 19 low legibility samples showed high variation in force, while only two of the most legible samples showed low variability.

TABLE V

FREQUENCY DISTRIBUTION OF SAMPLES GROUPED INTO THIRDS ACCORDING TO LEGIBILITY AND VARIATION IN FORCE

	Legibility		
Variation	High	Medium	Low
Low	10	7	2
Medium	7	8	4
High	2	4	13

Legibility and Actual Writing Time—The distribution of samples grouped by thirds according to legibility and actual writing time is shown in Table VI. This table shows that fast writing may frequently produce samples of poor legibility whereas slow writing results most often in highly legible samples.

TABLE VI

FREQUENCY DISTRIBUTION OF SAMPLES GROUPED INTO THIRDS ACCORDING TO LEGIBILITY AND TIME

Actual Writing Time	Legibility		
	High	Medium	Low
Slow	10	8	1
Medium	7	4	8
Fast	2	7	10

Legibility and Pressure—The distribution of samples according to legibility and pressure shown in Table VII gives less clear-cut evidence of a substantial relationship between these two variables than was found between legibility and speed of writing or between legibility and variability in force. While it would appear that good samples are seldom produced with high pressure—namely, one sample in 19—the number of poor samples produced at low, medium and high pressure is nearly the same.

TABLE VII

FREQUENCY DISTRIBUTION OF SAMPLES GROUPED INTO THIRDS ACCORDING TO LEGIBILITY AND PRESSURE

	Legibility		
Pressure	High	Medium	Low
Low	10	3	6
Medium	8	6	5
High	1	10	8

A Comparison of Results Obtained by the Various Types of Analysis

The results of the three types of analysis showed a high degree of consistency. The substantial rank-order correlations noted between variation in force and pressure, and between variation in force and time, are substantiated by the data secured in the analyses of individual patterns and grouped samples. Similarly, the

low rank-order correlations between pressure and time, and between pressure and legibility, are likewise supported by the other types of analysis.

On the other hand, the individual pattern and grouped sample analyses suggest a higher and more consistent relationship between legibility and time than the moderate rank-order correlation of .54 between these variables would imply. Likewise, the grouped pattern analysis suggests a more substantial relationship between legibility and variation in force than does the rank-order correlation of .59 between these variables.

The use of individual pattern and grouped sample analyses appears to have given additional insight into the relationship existing among these variables. Such relationships are frequently obscured when the analysis is limited to massed data only.

Significance of the Study

The present investigation was designed to record point pressure in the cursive handwriting of adults and to study the resulting pressure patterns in relation to rate of writing, legibility of writing and fine motor control. More specifically this study examined:

1. Point pressure patterns in relation to the legibility of the handwriting samples.
2. The effects of various rates of writing upon point pressure patterns.
3. The relationships between point pressure patterns and a measure of fine motor coordination of the hand.
4. The interrelationships among point pressure, legibility, rate of writing and motor control by individual and group techniques of analysis.

Before the investigation could proceed, it was thought necessary to provide a highly precise means of recording handwriting pressure. The instrument designed for recording point pressure employed a metal platen as the pressure recording surface which in turn was mounted on two strain gauges. Voltage changes developed by the strain gauges, as a result of minute changes in pressure on the platen, were transmitted through a vacuum tube amplifier to an oscillograph for recording. Thus a continuous record was made of minute fluctuations in point pressure during the handwriting act. Since the platen was placed flush with the top of a specially designed writing desk and since no recording mechanisms other than the platen were in the immediate vicinity of the writer, it was believed that a normal writing situation was approximated.

A constant writing task, consisting of a standard eight-word sentence which included all the letters of the alphabet, was used throughout the experiment. Three records of the writing task were taken for each subject—one at his usual rate of writing, one at a slower rate and one at a faster rate than usual. The standard sentence was written on a card placed over the platen so that an oscillographic pressure record was obtained as each sample was written.

The subjects of the investigation were nine men and ten women selected as the best and poorest writers from an original university population of 231 students. All samples of the standard sentence written by the nineteen subjects were judged for legibility and the resulting oscillographic pressure records were analyzed.

Specific Findings of the Study

The specific results of the study are based upon the analyses of the interrelationships among legibility, rate of writing, pressure and variation in pressure. These variables were examined in three ways: (a) rank order correlations of all samples, (b) analysis of individual patterns using rate of writing as a referent, and (c) analyses of grouped samples using legibility and rate of writing as referents.

The specific results of the investigation were:

1. Point Pressure and Legibility
   a. Rank-order analysis of all samples revealed a correlation of .01 between average sentence force and legibility of handwriting, thus indicating no apparent relationship between these variables.
   b. Analysis of grouped samples demonstrated that poor legibility samples were distributed almost equally among the low, medium and high pressure samples of the subjects. This confirms the low correlation found in the rank-order analysis.

2. Point Pressure and Rate of Writing
   a. The rank-order correlation between average sentence force and actual writing time of .22 shows little if any relationship between these variables.
   b. Analysis of individual patterns revealed that the sample written at the normal rate was most often written with the least average pressure. The fast sample was written at the individual's highest average pressure in 16 of the 19 cases. In no case was the individual's normal sample written at his highest average pressure.
   c. Analysis of samples grouped according to rate of writing demonstrated that average word and sentence force was typically much greater for both the slow and fast samples than for the normal samples.
   d. The findings of b. and c. above by different means of analysis support the conclu-

sion that as a person moves away from his normal rate of writing, his average pressure tends to increase.

3. Point Pressure and Motor Control
   a. The rank-order correlation between the force variation ratios for an individual's normal sample and the straight line motor control test was .86. In view of this high correlation, the force variation ratio for each written sample was considered a useful index of the subject's fine manual coordination.
   b. The rank-order correlation between average sentence force and the force variation ratios was .69. While this is a substantial relationship, the fact that this correlation is not higher suggests that average sentence force and the force variation ratios provide somewhat different approaches to the analysis of pressure.

4. Interrelationships
   a. The rank-order analysis of force variation ratios and actual writing times yielded the relatively high correlation of .67. Similarly, an analysis of individual patterns showed that 15 of the 19 lowest force variation ratios were produced at the individual's slowest time, and in all cases the individual's highest variation in force occurred at his fastest time. The analysis of samples grouped by rate of writing also supported these findings. In other words, as writing speed increases, the force variation ratios in most cases also increase.
   b. The rank-order correlation between the force variation ratios and legibility ratings was .59. This correlation suggests that as variability ratios increase legibility decreases.
   c. The moderately high rank-order correlation of .54 between legibility and actual writing times indicates that as rate of writing increases legibility tends to decrease.

In summary, then, the variable of force variation was most highly correlated with all other variables studied, whereas average sentence force was not highly related to any variable other than force variation. Individual pattern analysis indicated that fast writing was associated with higher pressure, greater force variability and poorer legibility. It may also be note that normal rate of writing resulted in the individual's lowest average writing pressure in most cases, but not in his lowest force variation ratio or most legible sample. Grouped sample analyses tended to substantiate the results noted above whether the basic referent was rate of writing or legibility.

Contributions

One of the contributions of the current study is the design and use of, perhaps, the most sensitive and accurate device yet employed for recording point pressure in handwriting. The use of electronic means of recording pressure, the care taken in the engineering design of the instrument and the precautions taken in its calibration represent a significant advance over the mechanical apparatus typically used in recording pressure in handwriting. Since this instrument permits the subject to write in essentially a normal manner, it possesses numerous advantages over more cumbersome and restrictive types of recording apparatus.

A second contribution of the present investigation is the development of a refined technique for interpreting records. Visual inspection of the pressure records had indicated that there were differences in pressure records which were not accounted for by measures of average word and sentence force. This suggested the possibility of developing a measure of variability of pressure for more adequate interpretation of the records. A force variation ratio was therefore devised to measure fluctuations in pressure. In the present study as the findings indicate this ratio proved to be the most useful method for interpreting the pressure records. The use of the force variation ratio represents a new and promising approach to the study of pressure phenomena in handwriting.

A final contribution of the study lies in its specific educational orientation. This study is not concerned with the examination of handwriting pressure in relation to character or personality. It is concerned with an examination of handwriting pressure patterns manifested at varied rates of writing with particular reference to the legibility of the handwriting. This represents an educational focus upon those aspects of handwriting with which every teacher need be concerned.

Implications of the Study

It is recognized that the population of this study of pressure patterns in cursive handwriting constitutes a very limited adult sample. Furthermore, the specific variables selected for investigation place certain restrictions on the nature and extent of the implications which may be derived from the study. It would appear, however, that within these limitations an examination of possible implications of this investigation for the teaching of handwriting and for further research is justifiable.

Implications for the Teaching of Cursive Handwriting—Since great differences in average writing pressure exist in adults, similar or even greater differences may be expected in chil-

dren whose writing habits are presumably less stable. Furthermore, since such differences appear to have but little relationship to the legibility of the handwriting, it would seem that teachers should not expect each pupil to write with equally light or heavy pressure. The findings of this study indicate that the average amount of pressure exerted in handwriting is a highly individual matter. This suggests that the use of handwriting drills designed to develop a uniform level of point pressure in all pupils is highly questionable.

The results of this study likewise suggest that speed of writing is a relative and highly individual matter. It would appear that each pupil should be allowed to seek his optimum rate of writing as he attempts to improve legibility. Speed drills designed to achieve a uniform rate of writing in a class appear to be a highly dubious handwriting practice. Teachers should be cautioned in particular against forcing a pupil to write faster than his usual comfortable rate, a practice which will almost certainly produce handwriting of lowered legibility.

Teachers may expect the most legible handwriting to be produced by those pupils exercising the greatest degree of fine motor control of the hand, or as defined in this study, the least variability in the force applied to the pen point. In view of the individual differences in such motor control among adults, it would appear highly probable that similar differences would exist among children. Such differences would seem to clearly imply that fine motor control of the hand is a very important aspect of the child's readiness for handwriting instruction. Since children's rates of motor development show great individual differences, as a substantial body of research indicates, the practice of introducing children to handwriting instruction at a uniform age or grade level may bear re-examination.

Legibility is usually considered to be the primary objective of handwriting instruction. This study suggests that great variations in legibility may be expected in children. In the attainment of this objective, certain broad implications for the teaching of handwriting may be indicated. Handwriting practices which are adjusted to individual differences in motor control and which allow each pupil to develop his optimum rate of writing and level of writing pressure should be encouraged. Conversely, those practices which initiate instruction in handwriting for all pupils regardless of their degree of fine motor control of the hand, and those which emphasize drills for uniformity in pressure and speed among pupils, should be deplored. More specific recommendations for handwriting instruction will necessarily await the results of further research.

Suggestions for Further Research—Since this study has resulted in the development of the force variation ratio, a new and promising index for the interpretation of pressure phenomena, it would seem highly desirable to extend this study to include a representative population of elementary school children. Such an extension of this investigation, with suitable modifications, would make it possible to describe various levels of development in the pressure patterns of children. In the course of such a study, the precise significance of the force variation ratio could be explored more fully and its usefulness for the prediction of legibility in handwriting could be determined.

Further investigation of pressure patterns in the handwriting of children would serve to extend the scope of the study in another sense. A major dimension of handwriting not investigated in this study is the effect of the legibility of the sample upon the writer during the handwriting act. The effect of this dimension is perhaps most important during the initial stages of learning. We may hypothesize that the child faces the handwriting task with certain internalized standards and aspirations which have to be adjusted as the product unfolds. Assuming that ideal standards exist, the child must lower or raise his level of aspiration, and develop realistic or acceptable standards during his writing. This constant goal setting and testing may be directly related to pressure patterns and speed of writing as well as the legibility of the sample. The force variation ratio discussed in this study may possibly be a method of relating pressure phenomena to the child's concept of the handwriting task.

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FOOTNOTES

1. A technical description of the platen, strain gauges and the electronic recording equipment used in the study is given in the original report. Technical specifications for the instrumentation may be obtained from the Committee for Research in Handwriting.

2. It was found that adults had no trouble producing a fast writing sample immediately following the slow writing sample; hence the "faster" writing sample used in the first study was eliminated.

3. Product-moment correlations were not used because the legibility rankings could not be reduced to scaled units comparable to those available for the other variables.

JOURNAL OF EXPERIMENTAL EDUCATION
(Volume 26, December 1957)

EDUCATIONAL IMPLICATIONS OF PERSONNEL INVENTORY OF SUPERVISORS, HEAD NURSES AND STAFF NURSES IN SELECTED HOSPITALS

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Delimitation of the Problem

PSYCHOLOGISTS have established that there are many motivating factors in human life. These have been categorized by Dr. Herbert A. Carroll (3) as, 1) the need for emotional security; 2) the need for achievement or mastery; 3) the need for recognition or status; and 4) the need for physical satisfaction. It is logical to assume that in his vocational pursuits the worker's psychological needs operate to create satisfactions or dissatisfactions with his employment. An examination of workers' complaints in business and industry supports this assumption.

Science Research Associates (23) reports that workers' chief complainsts may be categorized into:

1. Supervisor-Employee Interpersonal Relations
2. Working Conditions
3. Adequacy of Communications
4. Confidence in Management
5. Pay
6. Status and Recognition

The categories resulted from scientific studies on personnel problems of approximately two million workers in the United States in 1953. It seems reasonable to assume, that nurses' complaints may be similar to the complaints of other workers. Therefore, it will be the purpose of this study to discover the extent to which this assumption is true for supervisors, head nurses and staff nurses in four selected hospitals.

Survey of Previous Research Data

A dissertation entitled Supervisory Training and Employee Attitudes (22) was completed by Theodore Lindbous at the University of Minnesota in 1952. This study was done in industry and produced concrete evidence that on-the-job-training improves employee attitudes.

Another recent attitude study, What Do Nurses Think of Their Profession, by Bullock, sponsored by the Ohio State Nurses Association, dealt with the problems of morale and job satisfaction. Bullock concluded that nursing service organizations appeared to be highly individual-centered and expedient in order to maintain adequate nursing personnel. He pointed out in the strongly institutionalized organization, the leader's role is defined and the individual must conform to the set pattern. Thus, knowing the score and conforming to the pattern made decisions and interpersonal relationships predictable, but when individual centered unpredictable leadership activities and technics would occur.

Method of Collecting Data

Four reputable hospitals within the metropolitan Chicago area were selected for the study. For purposes of anonymity they were designated as "W", "X", "Y" and "Z". The hospital bed capacity ranged from 200 to 300 beds. All of them were under the control of religious orders; two were under the control of lay boards of trustees. Each operated a school of nursing.

To obtain "scientific insight" into the attitudes of nurses toward their jobs, the Science Research Associates Employee Inventory was selected for this study and was used as primary data. The test has been widely used in industry and has presented reliable data on two million workers, representing heavy industry, merchandising, processed food industry and a surgical supply company. The results are more than just a survey of opinions, they actually measure the company morale. In addition, the inventory furnishes other valuable information, evaluation of supervisory and training needs and material for supervisory training programs (23).

After the hospitals were selected, each Direc-

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tor of Nursing Service was contacted personally. The objective of the study was explained and the benefits which would accrue to the cooperating hospital were pointed out. It was felt that this approach would be more effective and more detailed than a written request. This initial contact was followed by a letter confirming the request. Dates mutually agreeable were arranged so that the test could be given during May and June, 1954. Two hundred and fifteen nurses completed the inventory: 31 supervisors, 52 head nurses and 132 staff nurses. After all nurses completed the inventory, an interpretation was made on the group as a whole, and in addition, the reactions of the supervisors, head nurses and staff nurses were analyzed.

Method of Scoring the Inventory

The answer pads for all the participating hospitals were scored by totaling the favorable responses in each category and entering the total in the appropriate box. The answer pads were then sorted into three groups (supervisors, head nurses and staff nurses) and the favorable responses in each category were totaled for each group. These totals represented the scores of the hospitals and each group were then divided by the number of participants in each group to arrive at the category favorable percent.

The category scores for the group were then plotted on the Report of Survey Results by locating the score on the percentile scale of national business and industrial norms, developed by Science Research Associates. These points were connected by a solid line and produced the profile for the hospital. This profile was then transferred to a Category Results Form.

Since the primary objectives of the survey was to ascertain educational implications, it seemed desirable to compare the favorable responses to each statement by each group. This was done by plotting the score of each group using the method described above. The comparison is illustrated in Table I. The groups were identified by using "G" for staff nurses, "H" for head nurses, and "S" for supervisors.

Analysis of the Data

The professional nurses category responses were considered in divisions recommended by Science Research Associates. These reactions are summarized in the following statements.

Group Results

1. Job and Conditions of Work. The job and conditions of work were generally considered satisfactory. Seventy-three percent recommended improvement in type of working equipment. Eighty-three percent agreed that management was cognizant of the value of accident prevention but made only average effort to effect such a program. By a 12 percent favorable response the group indicated satisfaction with their hours of work, but this was below the national business norm.

2. Financial Rewards. The nurses revealed a high degree of satisfaction with financial rewards of their profession. Sixty-seven percent were satisfied with their pay which is high when compared with the national business and industrial normas. However, 64 percent of the group manifested lack of knowledge and understanding regarding the hospital's employee benefit program.

3. Personal Relations. Working with patients gave satisfaction to 85 percent of the nurses. They also felt that the work environment was friction-free. Sixty percent agreed that they were free of self-appointed bosses, which may be considered low for a professional group. Twenty-six percent felt free to register complaints while 29 percent lacked confidence in the fairness and honesty of management.

4. Operating Efficiency. A 73 percent favorable response revealed that supervisors recognized the need for proper training for her employees. Seventy-nine percent of all nurses felt management was trying to build a good organization, but this is a marginally average response compared to national business and industrial norms. Fifty-five percent of the group felt interdepartmental cooperation was promoted by management and 59 percent felt their hospitals were being operated smoothly. Only an average response of 65 percent felt that there was an adequacy of communications.

5. Individual Satisfactions. Seventy-five percent of the nurses felt secure in their jobs while 86 percent felt secure as long as they did good work. The favorable response of 42 percent of the group revealed that length of service was not adequately recognized.

6. Reaction to the Inventory. Seventy-nine percent of the group agreed that the inventory might secure action on their problems. This response was within the average range of the national business norms.

Category Results of Staff Nurses, Head Nurses and Supervisors

The professional duties of the participants divide them naturally into three groups, namely,

TABLE I

STAFF NURSE, HEAD NURSE AND SUPERVISORS' RESPONSE

	Group I: Staff Nurse	Group II: Head Nurse	Group III: Supervisors
1. Job and Conditions of Work	Seventy-five percent of the group were satisfied with the hours of work. While 63 percent were tired and worn out on the job, 49 percent felt that the job demands were great. These responses are below the average of the national business and industrial norms. Only a marginally average response of 66 percent was elicited regarding the effectiveness of hospital equipment.	Forty-six percent of the participants agreed that the demands of the job were great which falls in the low section of the national business and industrial norms. A below average response of 56 percent was evidence of excessive pressure on the job, with 45 percent confirming job fatigue.	Ninety percent of the group were satisfied with their hours of work and 58 percent experienced fatigue on the job. Equipment was considered marginally satisfactory by 74 percent of the group.
2. Financial Rewards	There was general satisfaction with pay. Seventy-three percent of the staff nurses felt well paid in comparison with other employees in their hospital. A high favorable response of 59 percent agreed that their pay was good. The 58 percent response to the employee benefit program is considered marginally satisfactory.	In this group, there was also general satisfaction with pay. However, only 57 percent felt well paid in comparison with other hospital employees, and 63 percent understood the benefit program.	This group was satisfied with all aspects of financial rewards. Ninety-three percent agreed they were adequately paid and 90 percent understood the advantages of the employee benefit program.
3. Personal Relations	The staff nurses general acceptance of the friendliness and cooperation was demonstrated by a 92 percent favorable response. Twenty-two percent felt they were too closely supervised. Eighty-seven percent recognized a high degree of cooperation on the ward, whereas 69 percent felt free to make known their complaints.	Ninety-six percent of the head nurses concurred that the hospital environment was friendly, but only 75 percent agreed their fellow employees worked well together. Fifty-three percent, a low response, felt that supervisors were effective in creative team spirit, while 78 percent of the group were in accord with supervisors' technics and fair play. Fifty-three percent of the group agreed that their suggestions were accepted.	In every respect, the supervisors were satisfied with their personal relations. However, only 67 percent felt the effective creation of team spirit. Eighty-eight percent believed in management's honesty and integrity.

TABLE I (Continued)

Group I: Staff Nurses	Group II: Head Nurses	Group III: Supervisors
4. Operating Efficiency		
Ninety percent of the staff nurses expressed agreement that head nurses knew their jobs with 76 percent concurring that ward activities were well organized. An average favorable response of 55 percent agreed that management was trying to create cooperation between departments.	Head nurses expressed doubt about the efficiency of operations. Seventy-five percent believed the supervisors were technically competent; 59 percent, a marginally average response, felt the supervisor lacked ability to clarify responsibility; and 57 percent, a low response, believed the supervisors organized work well. Sixty-nine percent agreed that management was trying to build a successful organization, while 50 percent felt free to verbalize.	The supervisors, by a 93 percent favorable response, felt that management knew their jobs, but only 67 percent felt that management was willing to make decisions. A second low response was given by an 80 percent agreement that management was trying to build an effective organization, while 61 percent felt free to verbalize.
5. Individual Satisfactions		
Staff nurses generally experienced average individual satisfaction. Eighty-six percent were secure in their position and felt they would be retained on the job if performance was satisfactory, although 37 percent agreed that tenure did not offer security. An average response of 62 percent was elicited on fairness of the promotion policy while 81 percent agreed that their skills were adequately utilized and that there was opportunity for personal growth.	The head nurses' responses closely paralelled that of staff nurses. Eighty-two percent felt secure in their position and 36 percent felt that long service was recognized. The fairness of the promotion policy received a 65 percent favorable, while the adequacy of utilization received a 78 percent favorable. The head nurse gave a 90 percent favorable response to the meaningfulness of her job. This is the only point of unanimity among the three groups in the entire inventory.	The supervisors' group experienced a high degree of satisfaction in their personal relations. Seventy-seven percent agreed that tenure received adequate recognition. Job security was experienced by 90 percent of this group and an equal number agreed that their skills were adequately utilized. Ninety-three percent concurred that the hospital had a fair promotion policy.

staff nurses, head nurses and supervisors. The educational qualifications for positions in each category are not well defined which certainly suggests that they vary between hospitals and probably between geographical areas. The American Hospital Association and the National League for Nursing Education (20) only broadly suggest the educational requirements for supervisors and head nurses, but are more definite for the staff nurse.

In developing the comparison between groups, it was decided that a columnar presentation would demonstrate more clearly the points of agreement and points of divergence.

Educational Implications

Conclusions: It is desired that the general conclusions and recommendations of this thesis will arouse interest and thinking on the part of all groups concerned with hospitals. In some instances they may point to needed change in the approach to the solution of nursing problems. The two most significant conclusions applicable to all participating groups were:

1. The nurses were satisfied with their pay.
2. They felt that their professional duties were meaningful and valuable.

There were striking conclusions when the inventory results of each group are examined:

Group I—The staff nurses indicated satisfaction in most of the Inventory categories. The group lacked knowledge of employee benefits which implies defective or absent communication. There was also greater group-centered identification with the head nurse group than with the hospital.

Group II—The head nurses deviated from the average in business and industrial nurses, in many categories. They felt there was excessive pressure in their jobs; that equipment and working conditions were unsatisfactory; that administration was barely effective. While the profile configuration in some instances was the same as the supervisors, the favorable responses as a whole were much lower than the supervisor, and to a lesser extent, lower than the staff nurses. They lacked knowledge of employee benefits and were more acutely aware of the inadequacy of communications.

Group III—The supervisory group manifested a generally high satisfaction with nursing. In the majority of the categories their responses ranked in the high or the very high section of the scale. This satisfaction, particularly when compared to that of the personnel they supervise, was alarming and suggested complacency or complete unawareness of the problem which confronted them.

Recommendations:

1. That Nursing Administrators focus their attention on the head nurse group, since this group showed the greatest dissatisfaction.
2. That methods of communication should be carefully chosen, and proper recognition should be given to the need for verbalization by all groups.
3. That importance of technical achievement must not be under-estimated. However, there should be an acknowledgment by all nursing personnel that continued advances in the quality of nursing care are dependent on better supervision and human understanding, based on good human relations motivated by the effective application of the Golden Rule.
4. That every effort should be made to enhance the supervisory competence by utilizing good supervisory technics and including both individual and group devices.
5. That the whole category of status recognition be carefully studied with special emphasis on the effect of divided authority at the head nurse level.

In conclusion, it would seem that the problems revealed by the survey require the constant application by all groups of the principles governing the nature of supervision (1a). These principles are based on the fact that administration should be concerned with providing the material conditions and with general operation and that administration and supervision cannot be separated. Furthermore, good supervision centers around philosophy and science and operates on democratic principles. It is planned and creative but not prescriptive. Good supervision can be judged by its attainment.

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